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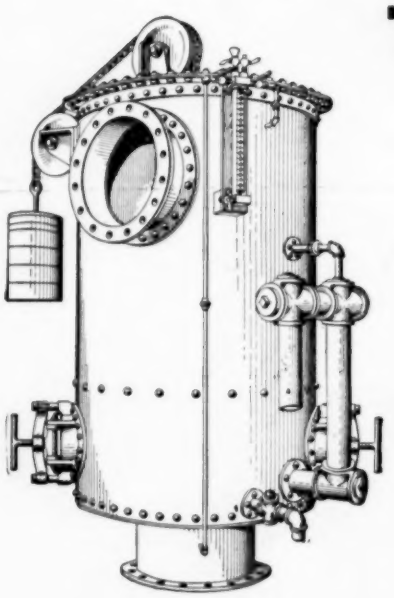

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EXTERNAL CORROSION OF CAST IRON PIPE.

From a paper by MARSHALL R. PUGH, read before the American Society of Civil Engineers.

Cast iron pipe is in such general use that a knowledge of its strong points, its limitations and the precautions necessary to insure its durability under certain conditions, is of the highest importance to the engineer.

"There is no limit to the life of cast iron pipe," says a recent advertisement in a technical journal, and this undoubtedly voices the opinion of many well-informed persons. Opposed to that we find the following: "The relatively high rate of self-corrosion (as distlnguished from electrolytic corrosion) of cast iron as compared to the other kinds of iron tested, is contrary to the generally accepted idea that cast iron is more resistant to self-corrosion than wrought iron."

We cannot go back very far in our study of cast-iron pipe. The earliest authentic records relate to pipes laid, by order of Louis XIV, near Paris, from the reservoirs of Picardie to those of Montbauron, supplying the town and parks of Versailles. According to the Ministry of Public Instruction and Art, these were laid between 1664 and 1688, and aggregate about 8,000 m. (26,000 ft.) in length, and are still in use.

"All of these pipe lines consist of pipes one meter in length, joined by bolted flanges. They are of considerable weight, and still serve their purpose satisfactorily.

"The few repairs that have heen required generally were necessitated by rusted out bolts."

At Clermont-Ferrand, Department of Puy-de-Dome, in 1746 the Commissioners of Fountains made an agreement with a Parisian iron merchant for furnishing about a mile of 5″ or 6″ cast iron pipe to supply water to the fountains. The lower portion, in the plain, was under quite heavy pressure, and was $\frac{8}{10}$″ thick; where the pressure was less, the thickness was only ½″. These pipes were in 3-ft. lengths, flanged, and with a lead gasket sometimes as thick as ⅞″. In 1867, the system was paralleled by new mains, but much of the original pipe is still in use. At Saint Etienne, in 1904, there were cast iron pipes that had been in service since 1782. A few years ago, the City of Paris abandoned the Chaillot Pumping Station, the first erected for supplying that city with water. The intake of flanged cast iron pipe, extending out into the Seine, was removed, after having been immersed in the river for more than a century. The pipes were found to be so well preserved that they could readily have been used again. The metal was a gray, cast iron of excellent quality. No alterations of either the interior or exterior appeared after its 100 years of service, and fractures were as sharp as those from a fresh casting.

London and Glasgow have a record of 120 years of service for cast iron pipe. The first extensive works in the former city were built by Sir Hugh Middleton, between 1609 and 1613. As early as 1766, the Chelsea Water Company of London, laid a 12″ flanged, cast iron pipe, which was relaid in 1791 on account of the joints "being perished." It was the engineer of that water company, Mr. Thomas Simpson, who designed the first bell and spigot pipes about 1785, at which time an experimental section with lead joints was laid. As a rule, however, London was supplied with water through wooden pipes until about 1820.

In the United States, the earliest pipes were of bored logs. Philadelphia adopted them, although, in 1804 about ¾ mile of iron pipe was laid as an experiment. The new Fairmount Water Works in that city had a distribution system of cast iron pipes, the first in America on an extensive scale. These pipes were imported from England, and were of the bell and spigot type, in 9-ft. lengths. A curious feature about them was that each length had three or four ribe or rings about it, approximately 1½″ wide, presumably to afford places with heavier walls in which to tap. These pipes are still in use after 95 years. Though forming only an infinitesimal portion of the present distribution system, they, nevertheless, constitute quite a considerable mileage. A few of them are noted to give an idea of their character: A 4½″ cast iron pipe on Chestnut Street, from Broad to 15th Street, laid in 1817, was removed only recently. A 22″ main leads from Fairmount Basin to Green Street, to Pennsylvania Avenue, to Callowhill Street; then reduces to 20″ to Broad Street and thence to Chestnut Street. This pipe was laid in 1819, and, with the exception of a portion removed in 1897 on account of the construction of the Pennsylvania Subway, is still in use. Mains on Market street, from Juniper to Broad streets, laid in 1820, from Eleventh Street to Juniper Street, laid in 1823, and from Water Street to Eleventh Street, laid in 1822, were in good condition when removed in 1907 for the Market Street Subway. Mains 6″ and 10″ in diameter, on Second Street, between Greenwich street and Lehigh avenue, laid between 1823 and 1852; 8″ mains on Front Street, between Wharton Street and Laurel Street, laid at various dates between 1822 and 1834; one 10″ main on Chestnut Street, from Front Street to Broad Street, laid in 1821 and 1823; and a 20″ main on Fifteenth Street, from Callowhill Street to Chestnut Street, was laid in 1829. All these mains are still in use.

The late James B. Francis, Past-President Am. Soc. C. E., cited the case of Lowell, Mass.:

"It is within my experience and knowledge that pipes at Lowell, obtained from Philadelphia in 1830, were intended for use under a pressure of 150 feet head, and are now in use under 200 feet head, without any signs of failure after 60 years."

Even when immersed in the fresh water of streams and rivers, this resistence to corrosion is manifested. Cast iron cannon taken from a vessel sunk in the Delaware River for more than 40 years, were perfectly free from rust.

Summing up what has been observed, it may be said that our experience of 250 years with cast iron pipe has not been sufficiently long to establish just what its life is.

EXAMPLES OF DETERIORATION OF CAST IRON PIPE.

One of the earliest observations of rapid deterioration of cast iron pipe is that of Mr. Thomas Duncan, who, in 1853, in describing the Liverpool Corporation Water Works, said:

"During the process of taking up and adjusting the pipes in the district near the margin of the docks, where the soil is impregnated with salt, they were found, in many instances, to have become so soft that they could easily be cut by a knife. These had not been laid more than twenty years; whereas, in the higher districts, where laid nearly fifty years, they were found to be as good as when first laid down."

In other words, under certain conditions, cast iron pipe is not durable unless protected. Therefore, it is of importance to the engineer to determine just what those conditions are and how to guard against them.

The salt of the ocean is particularly destructive to cast iron, and its action is manifested in a peculiar way, differing materially from ordinary rusting, scaling and pitting.

In contrast to the cast iron cannon removed from the fresh waters of the Delaware River and found free from rust, Major-General Pasley stated that the cannon of the "Royal George," sunk in the ocean for 62 years, and of the "Edgar," submerged for 133 years, had been examined by him. The cast iron had generally become so soft that the metal resembled plumbago in appearance and could be cut with a knife. The cast iron shot became red hot on exposure to air, and fell to pieces, but the cannon hardened after a time.

It is well known that iron filings will burn in the flame of a candle, and that very finely divided iron, obtained by the reduction of its oxides in hydrogen, is pyrophorous, that is to say, it ignites spontaneously on exposure to air. These cannon balls, therefore, may have contained a remnant of metallic iron in an exceedingly fine state of subdivision. The heating may also have been due to the rapid change from ferrous to ferric hydrate on exposure to air, or to a combination of the two causes. Just why the shot should heat up and fall to pieces, when the cannon did not, is difficult to explain.

The corrosive action of sea water is not uniform under all conditions, but may be materially accelerated or retarded. A case of this sort is cited by Mr. Robert Mallet:

"Iron under certain circumstances is subject to a peculiar increase of corrosive action—as, for instance, cast iron piling at the mouth of tidal rivers. The salt water being of greater density than the fresh, forms at certain times of tide an under current, while the upper or surface water is fresh; these two strata of different constitution coming in contact with the metal, a voltaic pile of one solid and two fluid elements is formed; one portion of the metal will be in a positive state of electrical action with respect to the other, and the corrosive action on the former portion is augmented."

Cases occur with considerable frequency, where trouble has resulted from laying cast iron mains in saline soils.

In 1902, the Elizabethtown Water Company, Elizabeth, N. J., laid about 2 miles of 6″ main across salt meadows. It was ordinary coated water pipe, about 0.45″ thick, laid about 8 inches below the surface of a salt marsh. The surface of the marsh was about 18″ above ordinary high water, and covered at times by salt water. The nearest trolley is about 3 miles away, so that stray currents had nothing to do with the observed deterioration. Only 7 years after it was laid, the pipe began breaking under pressure of 40 pounds, and it was necessary to renew the whole line in 1912. Internally it was in good condition. The external appearance was equally good, there being no pitting, but on closer examination, sometimes the top, sometimes the bottom, and, at other times, the sides, were found to have large spots where the iron appeared to be leached out, so that it could be cut like soft graphite. This action was not regular, sometimes skipping several feet, but was worst on the bottom. In some instances these soft places had eaten completely through, and although not pitted or swelled out, had lost all the characteristics of iron. After exposure to the air, this metamorphosed iron hardened. At Perth Amboy, N. J., similar trouble was experienced. A 16″ main, crossing a salt meadow for some 3,500 feet, had to be abandoned in less than 20 years.

At Atlantic City, N. J., the water main leads through salt marsh for a distance of 22,000 feet. In 1882 a 12″ cast iron main was laid, which, in 1888, was paralleled by a 20″ main, and in 1901 by a 30-inch steel main. In 1911 a 48-inch wood stave main was laid parallel to the three for about 7,000 feet, after which it takes a different route for the remainder of the line. Both the cast iron mains are soft in spots, and blow out from time to time under a pressure of 50 pounds. The deterioration is like that at Elizabeth and Perth Amboy. The steel pipe is even less satisfactory; though laid at a later date, it is rapidly deteriorating, and 6,000 feet of it are now out of service. The top of each of the two cast iron mains is about 1 foot below the surface of the meadow; the steel main is about half its diameter below the surface, the top covered with meadow sod.

At Richmond, Va., about 400 feet of 6″ cast iron pipe, laid in a salt blue marl, in 20 years became soft enough to cut with a knife, the action appearing to be equally great at its top, bottom and sides. A trolley track, 450 feet distant, may possibly have contributed to the disintegration.

Trouble has been experienced also from saline soils at points remote from the ocean. The Bureau of Water of Syracuse, N. Y., has had much trouble from corrosion or disintegration of water pipe in the salt lands. A line of pipe runs in a very low section of these lands, the major part of which is under water a large portion of the year. The part which is continually submerged has not disintegrated, but that adjacent to it, laid about 1904, began to fail after several years' service. The pipe was sound in parts, and at the leaks it could be cut with a knife.

A third soil destructive to cast iron pipe is noted at Syracuse:

"Since submitting this matter to you, I have observed two cases of disintergation in different parts of the town, the pipe being eaten precisely as that in Spring Street. In each case the soil above the pipe was composed in the main of coal ashes, and apparently the constant trickle of water had created some chemical action which ate the pipe. As a layman, I have concluded that coal ashes, where there is a possibility of a flow of water through them, are responsible for this particular kind of disintegration."

In Germany, R. Krzizan cites a case where a portion of an asphaltum-coated cast iron water main that had been in service for 20 years, suddenly became defective. A number of conical holes were scattered irregularly over the surface and were surrounded by graphite-like material containing particles of metallic iron. There was nothing in the water running through the pipe to account for this formation, but crystals of gypsum were distributed irregularly in the clay in which the pipe was laid. Krzizan attributes the corrosion to local currents set up between the graphite particles and the iron, in the presence of a solution of calcium sulphate, at the points where the crystals of gypsum were contained in the clay.

A question arises as to what effect the alkali soils of the West would have on cast iron pipe, and it is hoped that information on this point may be brought out.

The greater part of Montrose, Col., is underlaid by soil having an alkali content of from 200 to 400 parts per 100,000, and portion where it ranges from 600 to 1,000 parts per 100,000.

The superintendent of water supply, states that the system, built in 1888, consisted of 4″, 6″ and 8″ wrought iron pipe, which deteriorated so rapidly that it was all replaced either by cast iron or wood stave pipe, except about 800 feet of 8″, which is still in fair condition. Cast iron pipe that has been in use for nearly 20 years, appeared to be in excellent preservation, and has never given any trouble. The alkali soil, however, has been disastrous to the wire of the spiral-wound wood stave pipe. It was laid in 1905, and will have to be removed in a few years. There are no trolleys, and the pipe is laid 4 feet below the surface.

Before attempting to draw any conclusions from the facts presented, it will be desirable to consider the composition and character of cast iron, and to review the theory of its corrosion, and study some experimental data bearing on the subject.

The Composition of Cast Iron.—Cast iron is a substance of varied composition, both physically and chemically. It is known that common salt added to water progressively lowers the freezing point, until, with 23.5% of salt present, the whole mass freezes at —22° cent. This is said to be the "eutectic" composition, a compound that has a lower fusing point (or freezing point) than its components. With percentages less than the eutectic, crystals of ice form when the temperature of the water falls, the mother liquor becoming more concentrated, until the eutectic composition is reached, when the whole solidifies.

Pig iron, similarly, may be termed a frozen solution of carbon and iron. If no other impurities were present it would contain 4.3% of carbon, but addition of carbon lowers the solidifying point to the eutectic 1135°, and then raises it again as additional percentages are present. The free graphite found in cast iron, therefore, is due to the same action as the solid plates of salt frozen out of the water, with this important difference, that whereas ice does not retain any salt in solid solution, the solidified iron retains much carbon.

In pig iron heated considerably above its fusing point, the carbon tends to separate in the graphitic form, whereas the same metal heated to a lower degree, on cooling would retain more carbon in the combined condition. Much study has been devoted to this obscure subject, and a series of modifications of iron and iron carbon, all due to different conditions of heating and cooling, have been investigated.

To summarize briefly: the metal in the bottom of a blast furnace is a saturated solution of carbon in iron, and as it cools to the solidifying point, carbide is thrown out of solution. This splits up into iron and carbon. Iron solidifies, the mother liquor splits up, and the same process is repeated. It is analagous to the behavior of the salt solution.

The carbon in a casting, ordinarily 3 to 4%, may be all in the combined state, forming the intensely hard carbide of iron (Fe_3C) with a characteristic white fracture; or it may be in the form of free graphite, the numerous plates of which cut up and weaken the matrix of ferrite, the whole having the fracture of gray iron.

Each added impurity (and many are invariably present) increases the complexity of the casting, both chemically and physically, and sets up innumerable nodes for electrolytic differences of potential.

Corrosion of Cast Iron.—The rusting of iron is by no means the simple process it was once thought to be. How heterogeneous a casting may be in composition and physical structure has been shown. This adds materially to the difficulty, and explains the often apparently discordant results obtained by careful investigators.

Five separate theories have been advanced for the rusting of iron, but three of these have been practically eliminated, leaving two over which the fight still wages; the acid theory and the electrolytic theory. The one undisputed fact is that iron cannot rust in air unless water is present, nor in pure water unless oxygen is present.

The acid theory regards corrosion as resulting from an acid, usually carbonic, which unites with the iron to form ferrous carbonate ($FeCO_3$) for the soluble ferrous hydrogen carbonate ($FeH_2[CO_3]_2$), and the liberated hydrogen combines with any dissolved oxygen in the water to yield water. The oxygen of the air next converts the soluble iron salt into hydrated oxide, or rust, liberating the carbon dioxide (CO_2) which is now free to attack a fresh portion of iron. With a supply of water and oxygen, a small portion of carbon dioxide could thus rust an indefinite quantity of iron.

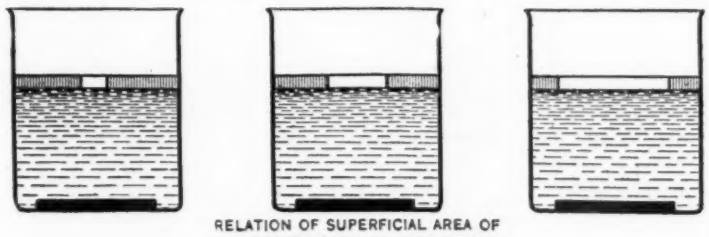
The electrolytic theory holds that the presence of an acid is not necessary, regarding the action as electrochemical.

If two platinum plates are immersed in a solution of common salt (NaCl), one plate connected to the positive and the other to the negative pole of a battery, hydrogen will be given off at the negative plate and oxygen at the positive. If a few drops of a solution of litmus are added, the liquid around the positive plate shows red, indicating the presence of an acid, and around the negative pole turns blue, showing alkali. The appearance of gases, and of red and blue color, is noted at once when the battery wires are connected, even if the plates are separated by quite a quantity of solution, giving strong support to the supposition that matter travels with the current, part toward the positive and part toward the negative pole.

If steel is immersed in a solution of copper sulphate ($CuSO_4$), iron dissolves and copper is deposited, the electric charge being transferred from the ions of copper to those of iron. Electrochemically, hydrogen is a metal classed with copper in relation to iron. If, therefore, iron is placed in a solution containing hydrogen ions, a similar reaction will take place, iron being dissolved and hydrogen passing from the electrically charged or ionic state to the atomic or gaseous condition, and is deposited on the iron. Ferrous salts, as well as ferrous hydroxide, are rapidly oxidized to the ferric state, if air or oxygen is present.

It is a matter of common observation that iron rusts in patches or spots. It has been noticed that if rusting takes place in water or in a neutral solution of an electrolyte, such as salt, to which a little phenol phthalein had been added, a pink color developed and is confined to certain nodes or spots. This pink color is a proof of the presence of hydroxyl ions, and indicates the negative poles. Add a trace of potassium ferricyanide to the solution and if iron goes into solution, ferrousions must appear, which, with the ferricyanide, form Turnbull's blue. This reagent indicates at once the positive and negative poles.

Whatever may be facts concerning the electrolytic and acid theories, if absolutely pure iron, pure oxygen and pure water are used, both reactions take place under actual conditions of corrosion.



RELATION OF SUPERFICIAL AREA OF WATER TO RATE OF CORROSION

Fig. 1.

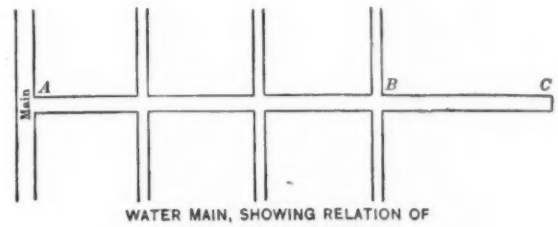
Natural waters are usually charged with dissolved oxygen and carbon dioxide from the air, thus readily permitting the action of carbonic acid on the iron. Even the purest commercial wrought irons are not homogenous, either physically or chemically, so that electrolytic action also comes into play.

The important part oxygen plays in corrosion can be shown experimentally. Fig. 1 shows three vessels, in each there is a piece of pure iron covered with fresh water. On the surface of the water were disks of paraffin, with holes cut in them, exposing progressively smaller areas of water surface to absorb oxygen from the air. After 5 days the pieces were weighed and the results are given in the Table.

RELATION OF EXPOSED AREA OF WATER TO RATE OF CORROSION.

Exposed area of water in square centimeters.	Relative corrosion.
56.8	100
12.6	58
0.8	14

The motion of water also has a bearing on the rapidity of corrosion. In certain circumstances it causes greater aeration and brings a supply of air to the rusting metal. An interesting example of this is illustrated in Fig. 2, in which a main, running from a larger main at *A* to a dead end at *C*, had a number of side branches. There was a continuously diminishing quantity of water and a diminished rate of flow, the greater the distance from *A*. After 45 years of use the pipe was found almost choked with rust at *A*, but with less and less of it toward *C*, the pipe being practically clean from *B* to *C*.



WATER MAIN, SHOWING RELATION OF VELOCITY TO CORROSION

Fig. 2.

It is a noticeable fact that in most cases of bad pipe corrosion that have come to the writer's notice, not only was there salt water, aeration, and more or less motion in the water, but the pipes were laid, as a rule, in muck with rank swamp vegetation in contact with the metal. The action of living matter, therefore, becomes of interest and merits careful consideration.

The direct action of any organism is doubtful, although it is known that organisms do occur in the tubercles forming on the inside of water mains. Dr. Brown states that "Organisms are found in some incrustations and may modify their composition; on the other hand, incrustations are often free from every trace of life." Mr. Richard Gaines found it probable that certain sulphur bacteria were responsible, in part at least, for rust tubercles and pitting in conduits; and cites that during repairs to the foundations of a bridge across Lake Hauser, Montana, the workman found protuberances they called "shell rust" scattered over the surface of submerged steelwork. Schorler identified in this rust *Gallionella ferruginea* in large quantities. Apparently the iron is dissolved by some acid secretion from these organisms, and, in this instance, the structrual damage to the bridge had been enormous. It is even necessary to consider the earthworm. It has been estimated that some 25,000 worms exist in every acre of soil, and each worm annually ejects 20 ounces of soil as castings, which means that 15 tons of soil in every acre of land pass through the worms each year. These castings are acid when fresh, and contain also small quantities of ammonia. With 15 tons of acidified soil per annum, with a small admixture of ammonium salts, there may well be a corrosive action on embedded iron.

Of still greater importance is the action of plants:

"Young roots, and especially root hairs, in addition to exhaling carbonic acid, excrete stronger acids, or acid salts, by means of which they dissolve insoluble bodies. That this is the case is readily demonstrated by allowing the roots to grow upon a polished plate of marble, when the latter will be corroded with an etched pattern showing the path of the roots. By placing the roots upon paper dyed with litmus their acidity may readily be demonstrated. Furthermore, when plants decay, humus acids result which are powerful solvents."

How important these acids may become is illustrated by some recent experiences in Illinois:

"In Southern Illinois a peculiar condition exists which undoubtedly has a material bearing on the corrosion of steel structures. In that portion of the State popularly known as Egypt, a large proportion of the surface soil shows a marked acid reaction. This condition exists generally throughout the greater part of the State that lies south and east of the Kaskaskia River and south of the latitude of Mattoon. To a less marked degree, the soil is acid in many places elsewhere in the State, where land has been farmed for 50 years or more.

"This acid condition does not exist for a depth of more than a few inches, and steel buried at a greater depth does not seem to exhibit any unusual tendency to corrode."

The destructive effect of carbonic acid has already been referred to; in swampy waters, for the reasons mentioned, it is high, and also in many well waters. It is, moreover, very soluble in water, so that it is in available form to attack any iron exposed to its influence.

It can be readily understood, therefore, that, by their secretions, plants and animals are important accessories in the corrosion of iron.

Conditions Inhibiting Corrosion.—While dilute solutions of alkalis do not retard corrosion, strong solutions neutralize the acids and preserve iron. For instance, 5% of lime applied to boggy, sour land exerted a pronounced retarding action on the corrosion of ironwork embedded in it. The same authority further says:

"There should be many cases where the property of alkalis to inhibit corrosion could be made of more practical use than has been done. Whenever iron posts or standards are set directly in the ground, the liberal use of slaked lime should be beneficial." The effect of concrete in protecting iron and steel is because of the two or more electrolytes in one solution.

Cast iron is poured into sand moulds, and the outer skin, therefore, is silicious. A 20% alloy of iron and silicon is not attacked by acids, and is virtually uncorrodible. Wallace refers to iron forged on a stone anvil, which does not rust on exposure to the weather, but takes on a fine brown patina. The question was raised whether the stone anvil did not siliconize the skin of the iron. By experiments it was found that, under a given length of exposure in soil, if the corrosion of machined cast iron was considered as 100, that of cast iron retaining the original surface was only 93.

This table, from various published data, shows the protective effect of the skin.

RELATIVE CORROSION OF CAST IRON WITH AND WITHOUT "SKIN."

	Foul sea water.	Clear sea water.	Foul river water.	Pure air and clear river water.	City air or sea air.
Cast iron.....	3.500	3.386	2.034	0.604	2.637
Cast iron (skin removed by planing)	12.275	4.738	3.884	0.584	4.763

Silicon is an undesirable alloy for iron in many ways, so that surface treatment, such as occurs in casting, is probably the only method of making use of its rust-inhibiting properties.

Chromium, nickel and copper, in small quantities, contribute greatly to the resistance of iron to corrosion. A steel containing about 1% of chromium was found by Hadfield to corrode about half as much as ordinary mild steel. Similarly, 3% of nickel added to steel reduced its relative corrosion in salt water about 50%. Phosphorus in iron also retards corrosion; differing in this respect from sulphur, which, by forming sulphuric acid, powerfully attacks the metal.

The coating of iron with zinc and tin is also used to inhibit corrosion. Zinc is electro-positive to iron, and if the two metals, in contact, are emerged in a corroding solution, the zinc will pass into solution and the iron remain unaffected. Galvanizing, therefore, is not merely a mechanical shield to the iron, but protects the metal for some distance around it. It is well to emphasize this fact, as it is a point frequently misunderstood. Tin, on the contrary, is not electro positive to iron. Being itself practically unaffected by corrosion, it protects the iron mechanically. The tin coating, as commercially applied, is full of minute pin holes, and does not inhibit corrosion at these points, thereby differing from zinc.

TYPICAL CASES OF DETERIORATION OF CAST IRON PIPE.

With these various facts in mind, an examination of typical cases of pipe failure may give information of value.

It has already been noted that most, if not all, pipe failures occur from the influence of salt or saline waters.

A 10″ main runs southward from Elizabeth, N. J., through the meadows to Morse's Creek, and is continued by a 6″ line. The general elevation of the meadow is about 18 inches above mean high tide, and the bottom of the pipe is approximately at the high tide level. There is no trolley near. Curiously enough, the 10″ pipe, laid in 1893, has shown no appreciable deterioration except at a point opposite the works of the Standard Oil Company, where escaping acid waters caused corrosion. The 6″ line, although not laid until 1902, has broken down completely. Both sizes were made by one company, and there is no apparent reason for the greater resisting power of the 10″ line.

The marsh is intersected by creeks and ditches, and the surface largely covered with fox grass. The patches too wet for the fox grass, are covered with what is known as quill sage, a course, rank swamp growth, and it is in these that the chief damage to the pipe occurs.

Fig. 3 is a photograph of a ring of the 6″ pipe, with two places deeply corroded at *B*, yet the exterior is smooth, to casual examination sound, neither swelled nor pitted. At *A* the same thing is noticed, except that a slight crack occurs between the sound and corroded parts in one place. Just below *A* the corrosion extends nearly through the pipe.

Fig. 3.—Ring from 6-inch Cast Iron Main, Elizabeth, N. J., Showing Corrosion.

The corroded portion has the general appearance and consistency and cuts like graphite. When first removed from the swamp it is softer, more like putty. When it is pulverized for analysis it is brown, and makes a brown streak on paper.

Filings from the corroded part, if sifted on a card with magnet beneath, fall as an inert mass, showing that when carried to completion, the iron is completely changed from the metallic state.

One piece of the corroded portion had this composition:

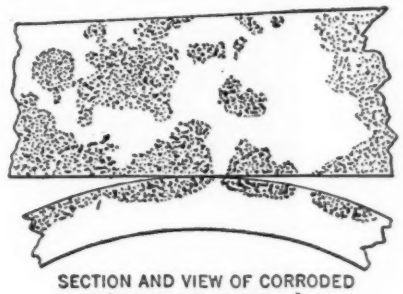
CORRODED PORTION OF PIPE FROM ELIZABETH.

Iron	50.62 per cent.
Silica	0.31 " "
Chlorine	0.72 " "
Maganese	0.46 " "
Silicon	22.32 " "
Combined carbon	0.63 " "
Graphitic carbon	5.51 " "

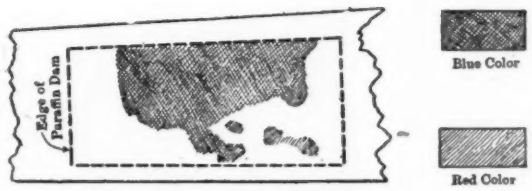
At a part not very deeply corroded, the specific gravity of a complete cross-section of the pipe was 5.18, and a piece from the corroded part of the pipe was only 2.2. The specific gravity of cast iron is assumed to be 7.15.

Fig. 4 shows in plan and section a piece of the corroded pipe. In this the sharp original outline of the metal remains even after the metallic iron has been completely removed or oxidized. A paraffin dam was placed around this piece of pipe, and ferroxyl reagent poured on. The lower part shows the result. Where there was deep corrosion, as at the bottom of the figure, no change took place. The iron alongside this developed two red nodes, showing the presence of hydrogen ions, and a wavy cloud of blue increased where the iron is passing into solution. A section of pipe, placed in a petri dish with ferroxyl, strongly developed the red color all

along the deeply corroded outside and a mass of blue from all the uncorroded portion.



SECTION AND VIEW OF CORRODED PIPE FROM ELIZABETH, N.J.



ACTION OF FERROXYL REAGENT ON SAME PORTION OF PIPE

Fig. 1.

At Atlantic Clity the behavior of the pipe was similar to that at Elizabeth. The conditions also were analagous, the chief difference being that the salt meadow was only 6 inches above mean high tide, so that the pipe was subjected to more frequent alternations of water and moist air.

Two samples of soil were collected from the Atlantic City meadows, one of them ½" from a corroded cast iron main and the other 3 feet away. The analysis is given below.

ANALYSIS OF SOIL FROM ATLANTIC CITY MEADOWS.

	Soil within ½ in. of pipe.	Soil away from pipe.
SIO_2 (insol. in HCl)	18.68%	32.27%
Al_2O_3, CaO, etc.	10.57%	22.78%
SiO_2 (sol. in HCl)	0.23%	0.28%
Al_2O_3 " " "	1.91%	1.19%
Fe_2O_3 " " "	46.57%	9.11%
NaCl	1.93%	0.95%
CaO (sol. in HCl)	0.99%	0.83%
MgO " " "	0.00%	0.00%
Sulphates	0.00%	0.00%
Organic acids	0.00%	0.00%
H_2O (at 105° cent.)	6.28%	28.92%
Volatile matter besides H_2O (ignition)	13.27%	3.96%

It has been shown that aqueous solutions of most acids dissolve iron. If hydrochloric acid is used, ferrous chloride and hydrogen are the resultant products, the former oxiding into ferric chloride in the presence of air. It has also been shown that if only a trace of acid is present, the iron will be deposited from the solution as hydrated ferric oxide. It is probable that in salt water the reaction may be represented by the equation:

$$Fe + 2NaCl + 2H_2O = FeCl_2 + 2NaOH + H_2.$$

In the presence of air, or of dissolved oxygen in the water, the free hydrogen oxidizes to water, the iron in solution yields ferric hydroxide, and the process continues. The chemical analysis of the portion practically free from metallic iron contains as low as 42.2% of that element, a small part of which is in the form of chloride. Clearly, part of the iron has been removed in solution and part remains as the hydroxide, the carbon present in the combined form being left behind, and, as shown in the microscopic sections, has thickened the plates of free carbon originally in the free iron.

The chlorides of sodium and potassium cannot corrode iron in the absence of air. Magnesium cloride, which is present in sea water in small quanties, is able to do so, but to get the full corrosive effect of sea water, plenty of air is essential.

It has been shown that the greater the surface of liquid exposed to the air, the more the corrosion is intensified.

In the salt marshes in question, the tide rises and falls, passing through a multitude of creeks and ditches all over the meadows. At Elizabeth, it ordinarily reaches about to the bottom of the pipe; at Atlantic City, it covers it, affording ideal conditions for corrosion. The liquid at high tide touches or surrounds the pipe; at low tide it falls, air rushes in to take its place, and a moist, saline, oxygenated, spongy mass of earth and roots surrounds the pipe. Carbonic acid probably contributes to the action. The Atlantic City meadow soil was free from organic acids. In the sample of soil taken ½-inch from the pipe, there was 46.57% of Fe_2O_3 and even 3 feet away iron occurred in large quantities, there being 9.11% of Fe_2O_3. This would appear to show that it had been dissolved from the pipe as $FeCl_2$, and, after diffusing or flowing away from the pipe as the tides rose and fell, was deposited as hydroxide.

It is to be noted that at Elizabeth, where the top of the pipe was not so frequently wet as the bottom, the blow-outs generally were in the bottom of the pipe. At Perth Amboy the top and upper sides suffered most. At Atlantic City also, the condition was worse at the top than at the bottom. This was to be anticipated on account of the relative elevations of the pipe and high tide. At Elizabeth the high tide reached the bottom of the main; consequently the top was not subjected to the saline influences so frequently. At Atlantic City the pipes were covered at high tide, and, being laid farther below the surface, air was more plentiful at the top, which, therefore, in presence of an ample quantity of salt water, and with a more abundant supply of oxygon than the bottom, suffered most.

At Syracuse, the portions constantly submerged did not give out. Probably, too, the concentrated saline content in these brine-soaked lands produced an inhibiting effect. The damage took place above the permanent water table, where both air and salt water could reach the pipe.

Analyses of the corroded and uncorroded portions of the Syracuse pipe are given below:

ANALYSES OF CORRODED PIPE FROM SYRACUSE, N.Y.

	Non-corroded portion.	Corroded portion.
Silicon	0.15%	1.49%
Sulphur	0.11%	0.20%
Phosphorus	1.26%	1.39%
Manganese	0.30%	0.38%
Total carbon	3.65%	4.21%
Graphitic carbon	2.85%	3.84%

"The corrosion contained 33% of insoluble residue, consisting of about 10% graphitic carbon and 22% of silicon (Si) and silica(SiO_2). Total carbon in the corrosion = 11.2%, consisting almost entirely of graphitic carbon. Sulphur in corrosion = 3.0%. Apparently the process which accounts for the corrosion either dissolves the greater part of the combined carbon or converts it into the graphitic variety."

An analysis of the soil surrounding this pipe disclosed that it was acid to phenol-phthalein, and contained 3.42% of organic acids. This is very interesting from its analogy to the soil conditions in Illinois, where steel bridges were damaged so badly by the acid soil.

On the whole, the evidence chiefly observed with cast iron pipe would seem to indicate that organisms, whether animal or vegetable, had but little to do with the effects observed. Salt water and air seem to be the active agents, probably aided by carbonic acid; and the exclusion of either is followed by increased durability of the pipe.

The evidence given where cinders caused pipe corrosion, the similer experience at Syracuse, and the German case resulting presumably from local electrolysis due to the presence of gypsum crystals, indicate the necessity for caution where pipe is likely to be subjected to such influences. Some years ago a tunnel leading from the Susquehanna River to the power house of the Central Pennsylvania Traction Company at Harrisburg, was constructed through the property of the Central Iron Works, on parts of which there were large slag dumps. The water flowing into the tunnel was so sulphurous from the slag that it greatly impeded the work, and was unwholesome for the workmen. Cast iron pipe in such a location would undoubtedly undergo rapid deterioration.

Where low lands are filled with cinders, ordinarily no trouble need be feared, but when subjected to periodical wetting and aeration, some precautions are desirable.

Acid mine waters are also very corrosive, and should be guarded against. In the mines themselves this would generally be economically impracticable, but in municipal works in the vicinity, where the pipe may be attacked, preventive means should be resorted to.

Prevention of External Corrosion.—Bearing in mind the silicious skin of cast iron pipe and its protective effect, and noting that chromium alloys of iron are resistant to acid attack, it occurs to the writer that some chromium compound, such as chromite,

mixed with the facing sand of the moulds might produce in castings a protective chromium skin.

It is a subject wherein an apparently well-reasoned argument may be completely upset. For example, as zinc in water, either fresh or salt, protects iron and is itself attacked, so if iron and copper are immersed in a liquid capable of acting on each, and connected by a conductor, a current will pass from the copper to the iron, and the iron will be dissolved. And yet, after a series of exhaustive experiments, Mr. Richard H. Gaines states:

"The legitimate conclusion from the foregoing experiments is, that rather less than more galvanic action arises from contact between steel and the other metals of the series, than from contact between steel and steel. In actual practice it has been found, that if a steel nut is put on a steel bolt and subjected to corrosive conditions, in a comparatively short time the steel nut will have to be split off, if gotten off at all, on account of rusting together; whereas a brass or bronze nut on a steel bolt under similar condition can be readily screwed off."

Mr. H. J. Force is authority for the statement that cast iron in pumping machinery was badly corroded by acid mine waters and as bronze bushings, valves, and impeller blades were used, it was thought that the action was due to galvanic action from contact of the two metals in the acid water. On substituting cast iron for the bronze valves and bushings so that the parts in contact would be of the same metal, the corrosion increased, and the cast iron deteriorated even more rapidly than when in contact with bronze. As far back as A. D. 79, this effect of iron on iron was noted. Pliny states that Alexander the Great, to repair a bridge over the Euphrates, "sometime bound and strengthened the bridge over there; the links whereof, as many as have been repaired and made new since, do gather rust, whereas the rest of the first making be all free therefrom." Modern experience has shown that if the old and new iron are of absolutely similar metal, one will be as durable as the other; but that if they are of a slightly different composition, it is not necessarily either the inferior or the newest metal which suffers most, that depending on the electrical phenomena resulting.

It is unsafe to reason too positively from results obtained with liquid electrolytes, as to what will happen to iron buried in soils. Moreover, time is such on important factor that conclusions drawn from accelerated tests may be most misleading.

"The relatively high rate of self-corrosion of cast iron as compared to the other kinds of iron tested is contrary to the generally accepted idea that cast iron is more resistant to self-corrosion than wrought iron. It is not improbable that this impression in regard to the superiority of cast iron has grown out of the fact that cast iron structures are usually made relatively heavy, and they tend to corrode more uniformly than wrought iron or steel, both of which factors would tend greatly to increase the life of the former."

The writer cannot subscribe to this view. The ordinarily accepted idea of the superior durability of cast iron arises, in his opinion, from the fact that cast iron, generally speaking, is more durable than commercial forms of wrought iron and steel.

A second method of protecting cast pipe, based on the rust-inhibiting properties of the chromates and certain other substances, whereby the iron is rendered "passive," does not seem practicable, in that a sufficient quantity of material to protect the iron indefinitely could scarcely be added to the soil surrounding the buried pipe at a reasonable cost. Therefore, this interesting phase of the subject has not been taken up in this paper.

The use of lime in the trenches, so as to encase the pipe in an inhibiting alkali, ought to be of service, and is worth trying. Encasing in concrete would be expensive, but would protect the pipe if properly done.

Another method, suggested at Perth Amboy, is to leave the pipe in open trench. This might help materially, as the alternate wetting and drying would probably be less destructive than the constant exposure to moist air, salt, and carbonic acid in the swamp or meadow soil. At Atlantic City this principle has been carried one step further, and the new 48-inch cast-iron water main across the salt marsh has been raised above the surface of the meadow about a foot so as to be entirely in the air. This would seem to solve the problem in a warm climate, or where the main is large enough to be exposed without danger of freezing, and where it is permissible to have the pipe above the service.

Bearing in mind the protective effect of zinc, it might at times be desirable to galvanize the cast iron in such locations, instead of giving it the ordinary bituminous coating. The United States Government has utilized galvanizing in some instances for the protection of gratings, covers, and similar castings; but as far as the writer is aware, it has never been applied to cast-iron pipe. Double galvanizing, as it is called, should be used in such cases. This is a trade term, which does not mean that the iron has been dipped twice, but merely that it carries a much heavier coating.

Conclusions.

First.—Under ordinary conditions of soil, cast-iron pipe has a probable life of from one to three centuries, as far as external corrosion is concerned.

Second.—Under certain soil conditions, such as salt marshes or saline soils, cast-iron pipe may be rendered useless in from 7 to 20 years.

Third.—At times, cinder and slag fills may exert a strongly deleterious influence. Acid mine waters are also destructive.

Fourth.—Substituting wrought-iron or steel pipe for cast iron is ineffectual. Cast iron will outlast the others.

Fifth.—Remedies fall under four heads:

A.—Increasing the skin resistance of cast iron;
B.—Utilizing the protective influence of alkalis by surrounding the pipe with lime or cement, where such is practicable;
C.—Exclusion of acids, salt, or air;
D.—Galvanizing the cast-iron pipe, thus protecting it at the expense of the zinc.

Sixth.—So many opposing factors are at work simultaneously that great caution is necessary in reasoning from effect to cause, and in suggesting remedies based on observed facts. The unexpected frequently happens.

Gas Meeters Band.

The Cleveland "Gas Meeters" have a band of their own, which furnishes the music at their outings and dinners. Henry Gadbau is leader, and much of the success of the Cleveland functions is due to him and his mates.

Accidents That Could Have Been Prevented.

These lists from Mr. J. B. Douglas should be read and heeded.

A lamp trimmer lowered an arc lamp to the roadway and left it while he conversed with a friend at some little distance. An automobile struck the lamp, injuring the driver and damaging the machine. Thoughtlessness of this kind is the cause of many accidents and is inexcusable.

After a crate was opened in a storeroom, a board with a nail in it was left on the floor, and an employee's foot was punctured. Injuries from protruding nails occur too frequently, and many are due to carelessness. Nail wounds are dangerous and should be guarded against.

A carpenter was opening a window when a piece of a broken pane fell out and cut his arm. Had the broken window been reported and repaired promptly, the accident would not have occurred.

A fitter placed a plank upon two iron drums. One of the drums had no head and the end of the plank did not reach across the opening. He stood on the plank with a pot of hot lead and stepped back on the end, the plank tipped causing him to fall and his face and neck were burned. The accident need not have happened had the man been careful in arranging the scaffold.

A laborer was working near a man who was breaking cement with a sledge. A piece of flying cement struck him in the eye. Accidents of this kind must be looked for when goggles are not used.

Salary Plus Commission.

From an article in "Electrical World."

Hundreds of dollars have been spent on sales department systems and equipment; thousands annually for men of experience to direct the selling staff. But how much attention is given by the average manager to the important question of the way to pay?

It is largely on the happiness and the enthusiasm of the men and women who sell the goods, that the measure of results depends, and happiness is based largely on our personal prosperity and the degree of hope that our apparent opportunity holds out to us. It is well enough to train the salesmen, to build up an organization spirit, to supply the spur of inter-competition and the ardor of a campaign; but the average yearly production is conditional on just two things — the kind of men you hire and the way they work. Buying the merchandise, planning the show room, training the men, and the advertising influence that supports the whole are all secondary in importance to that underlying fundamental source of stimulus and sustenance, the salesman's pay.

The matter is not one to be left to habit and tradition, as recent experience in the properties of Henry L, Doherty & Company has proved. Here is interesting testimony from a number of these companies that have recognized the vital influence of the compensation system.

Almost a year ago, when the European war was first felt in this country, every company operating public utilities was forced by the state of the bond market to husband its resources and to take measures of economy. To avoid the possible necessity of reducing the very large staff of salesmen in the Doherty properties, they instituted a new system of remuneration for all their selling force: a salary-plus-commission plan that decreased materially the direct outlay of cash, except for actual business gained, but at the same offered added opportunity to the salesman, based on his productiveness. The response was positive and quick, and the results proved four things:

1. That a commission paid on sales stimulates an able man and brings out all the good that is in him.
2. That commission compensation promptly detects and discourages the laggard, and eliminates him from the staff.
3. That a nominal salary is necessary, as it properly pays the men for necessary work that returns no commission.
4. That the proper combination of salary and commission makes a happy family and exerts a healthy influence on the market.

The details of the plan are described by Mr. John O. Chappell, manager of the new-business department of the Meridian (Miss.) Light and Railway Company:

"We put the new salary-plus-commission plan into effect on Oct. 1, 1914, paying a salary of $50 per month, and commissions on all electrical devices and gas appliances sold. The commissions ranged in amounts from 25 cents to $10—depending on the price and energy consumption of the article. If a sale is closed on the floor, the representative in whose territory the appliance is connected receives the commission, provided he establishes that the purchaser was his 'prospect' and that he had called upon him within thirty days. This can be determined by referring to the salesman's call sheets. When the plan was adopted the details were explained to the men, and they accepted the arrangement with confidence that their sales would increase and that their compensation would equal, if not exceed, their previous straight salary of $75 per month.

"As soon as the plan became operative we noticed that sales were stimulated, and that the representatives were constantly on the alert for new customers. At the outset a tendency to neglect smaller matters in the natural eagerness to win the larger business was apparent, but this was soon corrected, and the system shortly developed the conspicuous advantage of causing representatives to canvass with a greater degree of regularity—this being their best means of supplying themselves with names of possible customers. The plan also has a decided effect in reconnecting dead services, especially where service had been discontinued on account of high bills caused by inefficient appliances. The representatives have a splendid talking point here, and if successful in selling, the results are doubly to their advantage.

"We found the salary-plus-commission basis a wonderful means for proving or disproving a man's ability to transact good and substantial business, because it discloses whether or not he is selling for the money only. If he consummates a sale just for the money he personally gets out of it, he is likely to make misstatements that will later prove very embarrassing to him. Therefore the commission plan has the distinct advantage of enabling the manager to separate the wheat in his department from the chaff. For a man's work is judged not only by the volume of sales, but by the character of business transacted and the number of 'come backs'.

"We teach our men that every order must be complete, and so taken as to set forth every term and condition of the sale; and we require representatives to keep in close touch with the credit department and familiarize themselves with the consumers' ledgers. The personal interest that the commission compensation gives them has materially strengthened the feeling of responsibility."

The Denver (Col.) Gas and Electric Light Company has long been interested in ascertaining the influence exerted by allowing the salesman to participate in the fruits of his work. Mr. Clare N. Stannard, in discussing their experience, says:

"This company has tried numerous plans of compensation for its representatives. For instance, we originally tried a straight commission plan; then a small salary and commission. The next scheme was on a point basis, and then we changed to a salary covering a twelve months' period, with an arrangement for the men to share in the profits of the new business secured during the year. Then later we paid a partial salary, the representatives sharing in all increased revenue secured by them from month to month, this share being estimated on a 5% basis. This plan worked out very satisfactorily, because the representatives were then interested primarily in securing revenue for the company, either through the sale of appliances, through holding business, or through increasing revenue on present equipment, in which, of course, we are most interested.

"At present the men are working on a salary-plus-commission plan, the company feeling that the salary should reimburse the men for the work done by them not covered by commission. The salary covers, for instance, securing service applications and contracts covering gas and electric meters, adjusting high bills, settling complaints, securing additional consumption on present installations, etc. The commission is allowed on the selling price of gas ranges, water heaters, electric signs, various electric appliances, flat-rate and motor-service taken, etc. It is the consensus of opinion of those operating under this plan that the representatives are much stimulated by good commissions. We have always observed that the more they have the more they are anxious to secure.

"The plan has worked out very well. Statistics show that on a par man basis we are this year selling a greater number of appliances than last year, though we are not at this writing quite sure whether the additional appliances will bring us increased revenue, for on the present system it will be seen that the representatives are not nearly so greatly interested in revenue secured as under former plans, but rather in appliances sold. This might be considered a weak point in the system. On the whole, I do not feel that this scheme gives present consumers quite the attention that they received under former plans, nevertheless, the present basis is working out quite satisfactorily."

Mr. B. F. Noble, manager of the commercial department of the Montgomery (Ala.) Light and Water Power Company, adds some interesting points in regard to the assistance which any definite record of the value of sales affords the sales department. He says:

"The salary-plus-commission plan has worked out successfully in Montgomery. We are opening up quite a number of new fields for appliances that were practically unheard of here, and the change has not tended to cause our men to neglect customers or dead services. In fact, it has made them realize that they have to attend more closely to the wants of each customer in order to secure more business. Our comparitive figures on the business secured for the past 6 months and the same months last year, show that 40% of the force did 70% of the total amount of business done by the whole force last year. This means that each man has worked at least 50% in advance of the year before.

"As we look at it the change has put the new business men where they show their maximum efficiency. It is now possible to determine closely whether an additional salesman will pay for himself, and we do not hesitate to put on an additional man if we find it justified. In future, the force of the new-business department will depend more on the amount of new business to be secured, than on what a certain number of men can get. Heretofore men were hired in haphazard fashion, because somebody thought we needed them. Now men will be employed with a clear field before them. Another result of this change is that every salesman is taking an active and lively interest in the welfare of the new-business department and

(*Continued on page 74.*)

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NEW YORK, MONDAY, AUGUST 2, 1915.

Gas Lighting Week.

When a cult, a system or a style loses its hold, it slips into oblivion. The speed of its downfall depends upon the number of years of its popularity, and the extent of its acceptance. In wins by merit. In falls because of waning interest.

Gas lighting has had its hey-day, and its continuance in its rightful place rests upon the ability of the industry to keep up the interests by everlastingly demonstrating its merits.

A Lighting Week is an effective means for re-awakening interest, and all must get together to make it the success it should be.

Start to get ready now.

The N. C. G. A. has selected the last week in September as "National Lighting Week," and every gas company in the country is urged to co-operate in the movement to call to the attention of the public the improvements in gas lighting that have been perfected during the last few years, and to stimulate renewed interest in the use of gas for lighting.

The Publicity Committee is preparing a plan, and of course the best results can be obtained only if every company closely follows the suggestions, incorporating them with local special features. The results secured by the companies that participated in the Gas Range Week, should stimulate all to lay plans sufficiently in advance to insure their benefiting to the fullest extent from a national gas lighting campaign.

Rewards for Thought.

In order to maintain the Doherty spirit, and benefit by the originality of its employees of all grades, the firm of Henry L. Doherty & Company has announced that it will distribute neariy $3,500 in prizes for competitive papers during the next six months.

Thirty-two subjects have been selected, embracing the gas, electric, street railway, accounting, natural gas and oil, new business and bond departments, with employees' welfare a later possibility. One subject a month will be announced for each department, and 30 days will be allowed for preparation of each paper.

Prizes will be awarded by judges to be appointed by the firm members. Their identity will not be known to the contestants, and the judges will know the authors of the papers only by a number. Contestants have the option of sending their papers through their local managers or forwarding them direct to the New York office.

In rating the papers, 60 points will be allowed the original and constructive ideas, 30 for completeness and thoroughness, and 10 for clarity of expression. There will be neither credits nor demerits for grammar or style, except as stated.

For each of the 32 subjects selected prizes are offered as follows: First, $40; second, $20; third, $10 and $2 each to that half of the contestants—prize winners excepted—who are rated by the judges as having written the best papers. It is possible that the judges may decide to award a special prize for the paper deemed the best of the 32 winners, along the line of an "all-around championship,"

The committee that drew the plan for the contest consisted of Engineers F. C. Weber and R. L. Baker of the New York office, and R. R. Choate, general manager of the Spokane Gas & Fuel Company.

Mr. Edward Allen Dead.

Mr. Edward Allen, English gas engineer, is dead. He was engineer of the Liverpool Gas Company, past-president of the Institution of Gas Engineers, past-president of the British Commercial Gas Association, and a member of the National Commercial Gas Association. Mr. Allen was one of the best liked, as well as one of the best known of British engineers, and had a considerable circle of American acquaintances in the gas industry. Since the outbreak of the war Mr. Allen has done a lot of extra work, among other things serving as a member of the National High Explosives Committee.

Fire Place Heater Design Competition.

The joint committee on Fire Place Heater Design of the American Gas Institute and the National Commercial Gas Association, announces that seventeen designs were submitted in the competition instituted by it, and that the prize was awarded to R. S. Stokvis & Zonen of Rotterdam, Holland. The judges who selected the winner were three Philadelphia architects. Details of the prize winning design will be included in the report of the committee to the two associations.

International Gas Congress Special Trains.

Plans have been made for two special trains for gas men, their families and friends attending the Convention. One will run from New York, and the other from Chicago.

Because of the scenic attractions and dependable high class service, the following lines have been made the official route: New York Central Railroad to Chicago, Burlington Route to Denver, Denver & Rio Grande Railroad to Salt Lake City, and Western Pacific Railroad to San Francisco. The schedules have been arranged so that the trains pass through the scenic points of interest in daylight, and these include some of the natural wonders of the world. In order to forestall the possibilities of fatigue and monotony incidental to protracted journeys, stop-overs and side trips have been arranged at the most interesting points enroute,without materialy lenthening the schedule.

The International Gas Congress Trains de luxe will consist of electric lighted buffet-club cars, standard drawing room and compartment sleepers, dining car and observation lounge cars; with maid, barber and valet services included.

Schedule.

Lv. New York	8:02 P.M.	Sept. 19th	New York Central.
" Boston	4:45 P.M.	"	" " "
" Albany	11:45 P.M.	"	" " "
" Buffalo	7:15 P.M.	Sept. 20th	" " "
" Cleveland	11:00 A.M.	"	" " "
Ar. Chicago	9:00 P.M.	"	" " "
Lv. "	11:00 P.M.	"	C. B. & Q.
Ar. Denver	7:00 A.M.	Sept. 22d	"
Lv. Denver	10:00 A.M.	"	D. & R. G.
Ar. Colorado Springs	12:30 P.M.	"	"
Lv. " "	4:00 A.M.	Sept. 23d	"
Lv. Glenwood Springs	6:30 P.M.	"	"
Ar. Salt Lake City	9:30 A.M.	Sept. 24th	"
Lv. " " "	2:00 P.M.	"	Western Pacific.
Ar. San Francisco	5:00 P.M.	Sept. 25th	" "

The advantages outlined above are many. Think of traveling in a palatial special train among friends in an environment rivaling home club convenience, with all details incident to the trip in charge of competent railroad officials, who will look after the comforts and needs of the party the entire trip.

It is hoped that many will avail themselves of this unusual opportunity to visit California, when its attractions are greatest, and under most favorable conditions.

An illustrated booklet covering the trip in detail, giving full information regarding railroad and sleeping car fares, optional routes, etc., was mailed to every Gas Association member last week. If for any reason you should not get your copy, write to

B. J. Kellum,
Master of Transportation,
Washington Blvd. and Desplaines St.,
Chicago, Illinois.

SPECIAL ENGLISH CORRESPONDENCE.

Monthly Letter From Norton H. Humphrys, Salisbury, England.

THE POSITION OF THE GAS INDUSTRY IN FRANCE.—FACTS VERSUS FANCIES.—MUNICIPAL SURVEYORS AND PUBLIC ROADS.

The increased price of coal, which is one of the conseqences of the present European war, is causing great trouble to the gas undertakings in France, because the laws in that country fix the selling price of gas at a rate based upon the average cost of coal over the last 50 years. Unless some relaxation in the form of special legislation can be obtained, the position simply spells bankruptcy and cessation of business. In England, the rule is to allow a considerable margin. Companies under standard rates of dividend have a "maximum" selling price 25 to 50% above normal, and no special difficulty has so far become imminent. As regards the sliding scale, some margin is also allowed between the "initial" and a normal selling price, but companies under this regulation will have to accept lower rates of dividend, and where co-partnership schemes are in use, the "partners" will have to share in the loss. I have already pointed out the characteristic defect that fluctuations up or down are usually brought about by outside causes, and nothing is said so long as they tend to the advantage of the stockholders or workmen. But we are evidently entering upon a period when such advantages will be of a minus character, and it remains to be seen whether shareholders and workmen will be content to accept substantial reductions of interest and bonus respectively. Of the former class it may be said at once "hit them, they have no friends." They will simply *grumble* and bear it. I believe the problem runs: "*Grin* and bear it"; but a more literal translation would be "swear."

Going back to the other side of the English Channel, however, it is a singular thing that the war and invasion of 1870 had no immediate effect on the price of coal. Two years later, owing to the altered commercial and financial conditions thus brought about, a rise commenced, which came to a head in 1874, and altogether lasted about nine years. The maximum did not exceed 25%, and the average was under 20. But the struggle of 1870 was only a matter of weeks, although followed by internecine warfare that lasted longer. It is evident that a short strain, if it does wrack the vitals of a country, does not upset industrial conditions to the extent that follows when the war footing extends over months, or even years. In 1870 there was not the strain on the navy that exists over the whole of Europe. It is the ocean monsters, each one consuming hundreds of tons per day, that create a shortage of coal.

Possibly the French Gas Associations imagined that in England the coal consumer was as well protected as the gas consumer, for they sent representatives to England to inquire as to the position in regard to coal, who would not be long in learning that so far the government have found the matter a task beyond control. They have appointed committees, and held inquiries, but the coal owners ignore them, and simply threaten to shut up or stop deliveries if the government, or anyone else, attemps to regulate the "laws of supply and demand." I have already mentioned that the governing powers in other countries have been more successful, and now watch with interest the course that will be pursued in France, whether it will take the direction of a regulated price for coal, or a rise in the price of gas.

Gas undertakings have always been subject to misrepresentations, coming chiefly from the descendants of the Scotch Gardener mentioned, I believe, in "Adam Bede", who possessed such a keen natural insight into things that he regarded facts as a superfluity. So it is not surprising to find a statement recently put before a Parliamentary committee to the effect that gas companies are having the time of their lives. According to this authority (?) they are getting large supplies of coal due under contract at last year's prices, which the poor but honest coal owners are supplying at a loss. While thus securing coal at 6s. per ton under current prices they are obtaining the day's price for coke, and "colossal" prices for toluol. The facts are, that gas undertakings did not contract for more coal than they wanted in the summer of 1914, and that for every ton received on account of last year's contracts, they have already had to pay an equivalent in the open market at the day's price. Further, they are not securing anything like the full quantity of arrears due, and the deficit has to be made up by purchases at the day's price. Some of them have been known to be in a precarious position as regards the matter of stocks, and have been plundered accordingly. If they could have had their choice, there is not one but would have preferred to have had their deliveries according to schedule. They would have saved money by it, and probably have been able to resist the iniquitous 6s.-all-around rise that has been forced upon them. Some of them—not all—have probably been able to lift the selling price of coke, not 6s., but perhaps 3s. to 4s. per ton. But as the saleable coke is about half a ton on each ton of coal handled, the increased revenue from this source does not, at best, exceed 2s. per ton of coal. The price of toluol, "colossal" or otherwise, is a negligible quantity, because whatever may be said about the price, the total quantity obtainable from a ton of coal, including the extraction of every shred from the gas and from the tar, falls under the by no means "colossal" limits of half a gallon, and this small quantity is not secured without a considerable expense for fuel and labor in extracting the toluol by a process of repeated distillation and rectification. If we take the net profit of toluol, which is a different thing from the selling price, as having advanced 1s. per gallon, the additional revenue secured from that direction is only 6d. per ton of coal carbonized. But even that insignificant sum is outset by the decreased sales of pitch, and the consequent all-round decrease in the market price of tar. Very few undertakings are in a position to handle their tar. The majority have to sell in the crude state. The actual result is, toluol notwithstanding, that the receipts for tar and tar products show an appreciable decrease. Very few gas undertakings can say that they are not worse off, to the extent of 4s. per ton of coal purchased or more, than they stood in 1914, which is equivalent to about 5d. on the selling price of gas. Hence the necessity for an all-round rise on the gas bills.

Another authority has advanced the extraordinary theory that the gas undertakings have largely contributed to the present crisis by refusing to take consignments of coal due under contract during the past winter, preferring rather to deplete their stocks. If a single example of such an absurd policy is in existence, which is very doubtful, one would like to hear the reasons. Many concerns had no stock to deplete, after Christmas, and even assuming that the coal received is not balanced month by month against that consumed, in accordance with the usual practice, the most easy going of gas managers would know that his stock was running out before it got down to a matter of two or three days supply. In this part of the country there is scarcely a single works that can claim to have sailed comfortably through the winter in the matter of coal supply. The great difficulty has been, as I have before remarked, the congestion on the railways, and the high rates of freightage by water. All the south coast towns, who under normal circumstances had their coal carried by sea, are now chiefly dependent upon rail borne coal conveyed mainly across the whole length of the country, which accentuates the congestion already brought about by the demands of the military authorities.

At the Annual Meeting of the Institution of Municipal and County Surveyors, the question of trench openings and reinstatements was the subject of a paper, followed by a discussion. A fundamental error, common to gentleman of this persuation, was evident throughout the proceedings. It was to the effect that gas, water, or electric companies who have Parliametary authority to excavate trenches on the public thoroughfares, are to be regarded as common enemies, desirous of carrying out the work with the maximum amount of inconvenience to the public; and of scamping the reinstatement by carrying it out at the least possible cost, regardless of all other considerations, which incidentally include the safety and protection of the pipe or conduit that is the main object of the excavation. All parties concerned are probably agreed that the law on the subject, if anything of the sort can be said to exist, is in need of amendment. Two or three indefinite clauses in the Act of 1847, evidently drawn up by lawyers rather than by men having a special knowledge of the subject, govern the matter so far as gas mains are concerned. At that time, probably the heaviest vehicle in use on the road was a 4-horse wagon. Bicycles and motors were then unheard of, and conditions well suited to the road traffic of 1847 may well fail under the bicycle, motor car, motor lorry and steam road traffic of 1915. Mr. R. Brown, surveyor and engineer in charge of an extensive district on the outskirts of the Metropolis, was eloquent on the inconvenience caused to public authorities by statutory companies having power to open

the public roads. While it would be better, for several reasons, that the Municipal Surveyor should be the authority allowed to excavate in the thoroughfares under his charge, he admitted that such was not workable in ordinary practice, nor was it necessary, as there was no reason to suppose that any plan or suggestion that would obviate or minimise these inconveniences, would not receive due consideration on the part of the companies interested. At present, they can give three days notice, open, fill in, and maintain for a period of 12 months, or by agreement, leave the local authority to do the maintenance. It was not altogether practical for the municipal surveyor to supervise the whole of the work from start to finish, and unless this was done, satisfactory maintenance depended upon the care and skill exercised by the companies workmen. He proposed that parties who opened the road should pay for the attendance of a municipal officer who would supervise all matters connected with excavating and filling in. He was very keen on the question of filling in, and condemned hand ramming as inefficient. He would like to see it displaced in favor of mechanical rammers worked by compressed air, different shapes and sizes being used according to the type of trench. He recommended that road authorities should supervise all openings, at the expense of the company concerned, that the filling should be rammed in layers not exceeding 6 inches, and that surface material should be immediately replaced on a suitable foundation, and well incorporated with the surrounding or adjoining surface. Speakers taking part in the discussion addressed themselves chiefly to the question of maintenance, and thought the settlement of a trench was largely a matter of weather, nature of soil, drainage, etc. Instances were quoted of trenches laid under adequate supervision two years ago but that were still settling.

Our Big Scrap Heap.

In 1914 the value of the "secondary metals," exclusive of gold, silver, platinum, iron and steel, recovered in the United States was $57,039,706, a decrease from 1913 of $15,746,321, the secondary metals recovered that year being valued at $72,786,027.

This term "secondary" does not imply that these metals are of inferior quality, but is used to distinguish them from "primary metals," which are derived from ore. While the Survey figures relative to lead, zinc, copper, aluminum, tin and antimony given in this statement cover a large field and form an essential addition to the reports on primary metals, the scope of the inquiry probably reveals less than one-half the extent of the waste metal trade. The value of the old iron and steel re-used amounts to millions of dollars.

For a few purposes requiring especial purity of material, it is necessary to employ primary or virgin pig metal, but as a rule secondary metals can be used in whole or in part, and most foundries use them. The manufacturing and railway centers contribute the bulk of the metal waste, and when transportation is dull the production of scrap metal declines. Over 90% of the refining and smelting of drosses and scrap metals in the United States is confined to the territory east of St. Louis and north of the Ohio River.

The output of secondary copper (including that in brass) in 1914 was 127,882 tons, being over 22% of the primary copper smelted in the United States from domestic ores.

The lead recovered amounted to 61,062 tons, equal to over 11% of the primary refined lead produced in the United States.

The zinc recovered in 1914 was 71,642 tons, equal to over 20% of the production of primary zinc.

The recovery of tin is of great importance, there being no domestic tin ore smelted in the United States. However, some tin concentrates were exported from Nome, Alaska, in 1914. The secondary tin recovered in 1914 (12,447 tons, valued at $8,887,158) was over 26% of the tin imported during the year.

In aluminum the recoveries in 1914 amounted to 4,522 tons, valued at $1,673,140.

A Lubricant from Molasses.

A German patent has been issued to H. Steffens for making a lubricating substance out of beet-sugar molasses. The United States Commercial Attache at La Hague, in a report on the subject, states that it is not yet known whether the new lubricant is practicable, as it is still in the experimental stage. He adds that the normal production of molasses in Germany is about 450,000 tons a year, but that it would be an easy matter largely to increase this output.

(*Continued from page 71.*)

Salary Plus Commission.

the amount of actual profit made. Instead of a man working for his own benefit, he is now working for his benefit plus his desire to put the new-business department on a paying basis. He realizes that it is up to him to make the department 'a go.'"

Mr. A. K. Young, new business-manager for the Toledo (Ohio) Railways & Light Company, writes:

"Our new plan of salary-plus-commission is working out very advantageously for the men and for this company. From the start it was a success. When we first announced the change from simple salary, the men were a little dubious, but were willing to experiment and started out energetically to give it a fair trial. To-day they are making more direct sales than ever before. They are also selling appliances that they never gave the slightest attention to before. Personally, I think it is the best thing that could have happened to our new-business department. I am proud to say that we did not lose a man through dissatisfaction with the result, and they are better salesmen now than they were six months ago.

"Moreover, it has served to open my eyes to the ability of some of the men in the department. When I say that we sold $17,200 worth of merchandise through our new-business department last month, you will understand that they are working. Of this amount, $9,200 was for vacuum cleaners, which I think exceptional, for they cost $50 and up. The new compensation policy has a tendency to influence the men toward selling higher-priced articles. We are now selling electric ranges at from $60 to $110 and washing machines at $70 to $100, whereas under the old system, the men were more or less afraid of these articles on account of the high prices."

Mr. B. E. Jack, manager of the Salina (Kan.) Light & Power Co., comments on the need of careful scaling of the commission schedule. He says:

"I have believed for a long time that this was the only basis on which to pay new-business men. It spurs the laggard to higher speed and gives the 'rustler' a chance to make a better salary. It encourages the good man, and puts the poor one where he has to 'make good' or get out.

"The plan has worked out well here, and we have found it very satisfactory. At first the men were skeptical as to its value and did not welcome it, and for the first month they did not make very good salaries, apparently because they had but few 'prospects' lined up. Heretofore, in selling appliances the men worked along lines of least resistance and confined their efforts to the sale of the leading appliances. Now every man is anxious to sell everything we have to sell, and as a result we are marketing many kinds of appliances. We find that this, in itself, has had a wonderful effect on our general business, because it is advertising electric and gas appliances on a much larger scale. We are trying to teach our customers that we have a 'store' first, and a place to pay their bills second.

"We have found only one objection to the salary-plus-commission compensation. Many of the appliances sold produce very little revenue for the company, but their prices make it desirable for the salesman to sell them. Take, for instance, the electric washer. The one we sell is priced at $75, and the revenue from it would probably be about 30 or 40 cents a month, while the same amount of energy expended on selling an electric sign would probably bring ten times the revenue. Some of the companies have some sort of basis for paying for the sale of electric signs or flat-rate windows other than the commission on the installation price. This makes it more attractive to the salesman. However, we find this present plan causes very little or no tendency toward neglecting present customers or 'dead services,' because, after all, they are our best 'prospects' for appliances."

The opinion of the Doherty managers is not unanimous on every point, but they agree that the commission is an influence of great stimulative value, and should be utilized by everyone who hires a salesman. After all, the sole objective is production, and the employer is willing to give the man who sells the goods proper compensation.

One often hears: "I won't pay commissions. If a man won't work on a salary and do his best, I don't want him."

But that attitude is neither intelligent nor efficient. "His best" stands for quite a variable degree of efficiency, dependent on the salesman's state of mind; for when a salesman is discouraged and dissatisfied "his best" sells less, by far, than at times when nerve is good and hope is high. The man who feels himself to be succeeding and who is confident that he is getting on, has twice the production power. It is not a matter of honesty; it is a matter of mental energy. Starve your body and you lose your muscular strength; fail to feed enthusiasm and hope and you weaken your eagerness and initiative.

Summary of Commission Regulations Governing Gas Supply.

State	Quality requirements: Point of test	Candle-power	Burner	Standard	Heating value: Month avg.	Heating value: Daily min.	Purity: H_2S	Purity: Total sulphur 100 cf.	Purity: NH_3 100 cf.	Pressure: Point of test	Pressure: Max	Pressure: Min.	Pressure: Daily variation	Meter testing: Allowable error	Meter testing: Period in years	Meter testing: Min. period for complaint tests	Meter testing: Fee for complaint test by Commission	Meter testing: Refund by Company for fast meters	Meter testing: Routine meter testing by	Penalties
Arisona	Within 1 mi. radius of distri. center.	—	—	—	600	550	trace	30 gr	—	Meter outlet	—	1¼"	—	3%	3	12 mo.	$1.00	Refund of fee	Company	None
Illinois	At least 1 mi. from plant.	—	—	—	565 total 530 compressed gas	530 520	1 gr.	30 gr.	—	Meter outlet	8"	2"	100%	2%	5	6 mo.	0-10 lt. $2 10-45 $4 over 45 $8	Refund of fee adjustment bill past 6 months	Company	None.
Indiana	1 mi. from distri. center.	—	—	—	600 total	550	trace	30 gr.	—	Meter inlet	6"	1½"	100%	2%	3	6 mo.	$2.00	Refund of fee	Company	None.
Maryland	Within 1 mi. mfg. plant.	Balto. only 20.1	—	candle	State 600 Balto. + 645 total	State 550 Balto. 595	trace	30 gr.	10 gr.	Service outlet	6"	2"	100%	1% 15% may be 2% in error	—	12 mo.	0-10 lt. $1 20-45 " $2 over 45 lt. cost of test	Refund of fee if 2% fast	Company	None. + Balto. requirements contingent upon retaining price of 80¢ gas.
Massachusetts	¼ mi. from works.	16	—	candle	—	—	none	30 gr.	—	No requirements				2%	—	—	Fee + exp. of removal	Refund of fee	Commission	$100 for quality or purity if deficient on 3 consecutive inspections.
Montana	1 mi. from distri. center.	—	—	—	475 total	450 total	trace	30 gr.	—	Meter inlet	5" + 1" per 125' above holder	1½"	100%	2%	5	12 mo.	Actual cost $2 minimum	Refund of fee	Company	None.
Nevada	1 mi. from distri. center.	—	—	—	550 total	500	trace	30 gr.	—	Meter inlet	6"	1½"	100%	2%	3	6 mo.	$1.50	Refund of fee	Company	None.
New Hampshire	1 mi. from mfg. plant.	—	—	—	600 total	550	trace	30 gr.	10 gr.	Outlet service	8"	2"	3"	2%	5	12 mo.	0-10 lt. 50¢ over 10 lt. at cost	3% fast refund fee + overcharge 6 mo. — 3% slow. Co. may correct charge past 6 mo.	Company	None. Commission charges $15.00 for each inspection which is made at will of Commission.
New Jersey	1 mi. from distri. center.	—	—	—	600 total	550	trace	30 gr.	—	Meter inlet	6"	1½"	100%	2%	6	6 mo.	$1.00	Refund of fee	Company	None.
New York, 2nd class cities	1-1½ mi. from nearest distrc. holder.	Coal . . 16 Mixed 18 Water 20 Albany 22	F F #7 Bray	candle	—	—	none	20 gr.	10 gr.	Service main	3¼"	1½"	—	2%	—	—	$0.75-$5.00	Refund of fee	Commission	None.
New York, 2nd District	1 mi. from nearest distri. holder.	Coal . . 16 Mixed 18 Water 20	D or F Argand or #7 Bray	candle	—	—	none	20 gr.	10 gr.	—	—	—	—	2%	—	—	$0.75-$5.00	Refund of fee	Commission	None.
Oregon	Any point within 1 mi. mfg. plant.	—	—	—	600 total	550	trace	25 gr.	5 gr.	Service outlet	6"	2"	2"	1%	5	12 mo.	$2.00-$8.00	3% fast refund fee fee + 3 mo. overcharge. May chg. if 50% slow.	Company	None.
Pennsylvania	1 mi. from mfg. plant.	—	—	—	570 total 550 coke oven gas 800 natural gas	520 500	—	30 gr.	—	Meter outlet	8"	1½"	100%	2%	5	—	$2.00-$10.00 pos. $15.00 - $50.00 for propor. Fee pd. to Co.	Excess of the current bill.	Company	None.
Washington	—	—	—	—	600 total	550	trace	30 gr.	5 gr.	Meter inlet	5" + 1" per 125' above holder	2"	—	2%	5	12 mo.	$3.00	Refund of fee	Company	None.
Washington, D. C.	Any Comm. testing station.	—	—	—	600 total	550	trace	30 gr.	5 gr.	Service outlet	6"	2"	100%	2%	5	12 mo.	0-60 lt. 50¢ over 60 lt. $1.00	Refund of fee	Company under Comm. supervision.	None. Supervision fees: Under 60 lt. 10¢ Over " 20¢
West Virginia	—	—	—	—	—	—	—	—	—	—	—	—	—	2%	Reg. 5 Pro. 1	—	$1.00-$10.00 and over	—	Commission. Company may reset O. K. meters.	None. No fee for routine meter testing.
Wisconsin	—	—	—	—	600 total	550	trace	30 gr.	—	Outlet service	6"	2"	100%	2%	4	6 mo.	2-10 lt. $2.00 20-45 " $4.00 over 45 $8.00	Refund of fee	Company	None.

This interesting table, taken from the July issue of the "Institute Bulletin," was compiled by Mr. J. B. Klumpp, Secretary of the Public Relations Committee, A. G. I., and gives at a glance a comparison of the testing and service regulation of the various States.

Hints for Salesmen.

From address by JOHN GEORGE JONES before the New England Section N. C. G. A.

The salesman's object is to get the buying people in a buying mood. A great deal is said about efficiency in business, and, of course, a selling organization of any corporation needs to be efficient. There are several ways for improving men for increasing individual efficiency. The first is "Imitation." We are nothing more or less than imitators. If we were born in Germany or France, we would imitate them; if in France we would talk French, and in Germany we would talk German. Imitation is what develops man; as he grows he imitates his elders. It is important when we get into the business game, that we pick out the right man to imitate.

Co-operation. — Years ago we did not have any large public service corporations. Individual business, by imitation, grew to co-operative business and to the public service corporations of today.

Loyalty begets loyalty and you have a right to look to your corporation, to the men who hire you and pay you, and expect loyalty in return for that which you give. Corporations show loyalty to their men by educating them, and offering them other advantages and comforts. Dr. Lee Galloway has been instrumental in building an educational course that will help corporations to help their men who are deserving of loyalty. If you give loyalty in return, your future is safe. We are serving ourselves when we serve our corporations faithfully. Promotion may be slow in coming, but it is as certain to come to the one who is loyal and industrious, as it was thirty years ago to the man that had a pull. Every man has to bear his load, whether a salesman, engineer, accountant, or superintendent of a gas plant; they all assume responsibilities.

Concentration. Many men fail in life because they do not concentrate. Concentration is one of the hardest things to learn. Settle down on one definite purpose and love the work of obtaining it. We must choose our vocation and, when we have chosen it, learn to love it.

Wages. There is no question as to wages these days, as corporations are willing to pay a man what he is worth — and oftentimes more.

Pleasure. I know of no greater pleasure than playing the game —whatever the game is. Your meeting here together and discussing problems, and in a social way broadening your business principles, should be a pleasure. A man can't be efficient who forswears everything that is a relaxation. Going to a ball game or rowing when you feel mentally fatigued, will increase your inefficiency.

Love the Game. I lived in a mining camp where they burned soft coal for fuel, and usually lost my appetite when I saw the women come in from the hot kitchen to wait on the table, It isn't a question of selling a few more lamps, gas stoves, etc., you should think of the customer's comfort in the appliances you sell. Think of the poor mother in the hot kitchen—who hasn't the full opportunity to bring up her children, usually telling them, "Mama is tired."

These people are trying to solve your problem. Picture to them a cool, clean and efficient kitchen with the use of various gas appliances, Sell them anything that is for comfort, improvement, etc. Sell them once—give them service always—go back and see if they like it, and if they do, you can sell them anything. Keep handling bigger problems, build up straight personality, build a future for yourself.

Constructive Thinking.—Never let a yellow streak creep in when business is bad. The fellow who can stand up against adversity; who goes out in the morning and plugs hard all day, and even if he does not sell anything, comes back in the evening with a smile—he is the kind that is sure to meet with success. If you have a list of customers to whom you have sold, call on them and see if they are satisfied with the service. You may get more prospects this way than by calling on new prospects. The strongest asset today is the customer who comes into your store and goes out satisfied. People are getting a little more careful, but they are just as willing to spend a dollar for real service or real value as they ever were. One of the most important things to do is to study the people. You have a stove to sell and land the order—no question about that; but don't go out thinking you are a salesman because you got the order. Think why you got that order. If you go away without an order that you thought you had, think why you lost it. The salesman who quits thinking stops selling.

Ideals.—The man who works for daily wages only, is never a very big success. The world is full of laborers—of men who go to work on time-clock schedule, always looking forward to Saturday for the pay envelope; but that kind of laborer never gets very far unless something is back of him. The man who is made foreman or superintendent never watched the clock, or worked for salary or commission. His mind was in the game. He had ideals. Do some constructive work—assume some responsibility. The man who works for something more than the pay envelope he will receive on Saturday night is the man who is of value to the employer. Salesmen who think will have a future. It probably is tiresome telling the same story every day, and it may be tiresome being President of the United States. Billy Sunday might say, "I'm all in—I don't think I'll take another appointment"; but the prohibitionists over in England invited him to bring down the breweries. When we say we are tired, the trouble is that we stop thinking—we are mentally fagged. The fellow who loves his work, the salesman who goes out with the idea of delivering service to the community, the one who never complains about his work being tiresome, is the one who will reap success.

Salesmen hear a lot of kicks. Don't worry the Vice-President, Treasurer or Auditor with them, let the customers know that you are the one they want to see. Get the co-operation of the people, sell them as many times as you can, try to give them service. When they complain of the quality of the gas, don't apologize for the corporation. Tell them that there might have been clinkers in the coal, or that they might have received an electric shock if they used electricity. Nothing is perfect.

It is up to you salesmen to get out and sell, and win the confidence and secure the co-operation of the people; for if you don't, the representative of the electric company will call, and tell them about electricity and insulation that will never give them a shock. Tell them how many people are burned by electricity — tell them the thousand and one reasons why gas is better. Use imagination. It is your business to increase the clientele. People may tell you that some hardware dealer is selling a lot of stoves. When they tell you that, go after them and sell them *gas* stoves.

Service. How many of you salesmen carry note books, and when you hear a complaint, write it down and turn it in at the office, keeping duplicate to see if the company does the right thing by attending to it? You represent the gas company and when you go into Mrs. Smith's house, don't imagine for a moment that she is thinking of your president or treasurer — she is thinking of you. Tell her that your company wants to give her service. Secure her confidence, so that should you call there again, she will thank you for the good service she has received, and will be willing to buy of you again. The real pulse of the gas company is the salesman, and the meter reader.

Selling. I have heard men say that selling is a hard game. It is if you make work out of it and don't love the game. The man who takes himself too seriously is not very frequently liked. The fellow who thinks he is an Atlas and that his job is what keeps the company going and the world moving, does not get very far. The real salesman looks upon the bright side of life, and the man who doesn't look upon that side is foolish. If you have had a poor day or did not sell anything, don't start out next morning with a grouch. Don't go to Mrs. Brown with a chip on your shoulder. If she don't put in the stove, tell her to talk it over with her husband. Tell her how much rest she will be able to take if she installs a gas stove—that she will have more time with her family—a cool kitchen to work in, and many more convincing arguments. Go and see her husband and make him see the benefits of a gas stove. It is up to you salesmen to study these things. Many women say, "No" when they mean "Yes." Make two calls and see the "old man." It is a cinch that the woman wants it and the man thinks he can't afford to get it. You have no right to get sore with people who don't buy anything from you. The fellow who carries a grouch against people soon becomes a grouch himself.

I would give anything if I had the ability to put on canvas the face of someone I love. The gift of the salesman is just as wonderful if he is able to paint pictures of his prospects; pictures that build up your business; pictures that appeal. Don't think only of your business. Keep in touch with other topics; read the newspapers, do things that will awaken your imagination. The better informed the man is, the better chance he has to hold opportunity when it knocks at his door. There is no man I pity more than the fellow who does not learn of other things.

Half the success of a salesman depends on the co-operation of the manager. You managers are the thinking department, and play an important part in the game. You have to co-operate with the salesman in every way possible; help them in the organization of their territory, cheer them and encourage them.

The man who delivers the goods is the man who goes after the orders in the right frame of mind, who is determined to bnild himself up as a salesman. It is only just that managers should tell you if you have reached the limit, so that you can go elsewhere and seek opportunity.

The Present Commercial Gas Situation in Texas.

[By F. M. LEGE, JR., before the Southwestern Electrical and Gas Association.]

The gas situation, as a whole, in Texas, is one that would require more time and space to treat properly than is allottod me by the Committee, and, therefore, I will simply express my views relative to the possibilities of the natural and artificial gas business from a commercial standpoint.

Texas now has several good natural gas fields and a number of artificial gas plants that are growing very rapidly. Gas for industrial and domestic purposes is becoming more popular each year, and it is only a matter of time until every household will utilize gas for domestic purposes. The development of the gas business in Texas has been slow and expensive. This condition has been common to many other industries, due to our scattered settlements, which have made necessary long extensions that were not, and many are not now, profitable to the gas companies. Our people have not been accustomed to the use of gas, and it has required time to educate them in its general use; and now it is up to us to further educate them in economical use of our product. The population of our cities is rapidly increasing, and as the younger generation grows up the use of gas will rapidly increase; our cities will become more densely populated, which will increase the customers per block of main, which in turn will reduce the investment per customer; and eventually the gas company will come into its own, and the pioneers' dream of big gas business in Texas come true.

The natural gas development of the State is as yet in its infancy, and I regret the way our natural gas is being wasted by all who use it. I further regret that in the natural gas belts "price per thousand" has been the watchword of the people. I know you will say that the prices in Texas are not lower than in Northern natural gas belts, and I agree with you. This, however, does not change my views, for I contend that all natural gas prices are too low and are detrimental to the gas industry; furthermore in the Northern States their winters are much longer and their summers more severe, with a result that they are required to use more gas per year, and in addition have much denser populated cities from which they draw their revenue.

I believe the time is coming when we will sell "service" with natural gas, instead of simply distributing gas, and when that time comes, I wonder how we can raise the prices to where we will receive the proper compensation for "service." The public is demanding more service each year, and usually pays for it; as we must admit service costs money, some one has to pay the bills. If

it were possible to raise the price of natural gas 50%, won't you agree with me that we could, by inspecting and properly adjusting the different appliances, insure our customers that their monthly bills would be but very little higher than before, if they would assist us by using the gas properly and being more economical, which would result in much better service? With an increase of natural gas prices of 50% it would be possible to conserve our fields to some extent; it would not tax our pipe lines as they are now taxed, and it would enable the distributing companies to receive a fair return on their investment for domestic consumption; whereas now the distributing companies all over the State are losing money on practically every domestic customer, with the result that the customers are not pleased and the distributing company cannot afford to spend any time educating the customer, inspecting their appliances, and seeing that they have the proper appliance for the service desired. The distributing company now simply reads the meter, collects the bills and watches the pressure, and the cost of doing this invariably exceeds their profit on the gas so sold.

To try and overcome this condition the distributing company seeks industrial business, and where the quantity obtained is sufficent they are sometimes able to take care of their bond interest and a little for depreciation. The above does not apply only to natural gas companies in Texas, as their are few artificial gas companies in the State that are making a "fair return" on their investment and efforts.

The gas industry, as a whole, has overlooked the question of a proper rate on gas. I do not attempt to say that the industry is entirely to blame, as I feel it is a case of the company and the politicians, and, last but not least, the hope of the gas companies of making the volume take care of the reduction in price, and depending upon the people to watch their own appliances and consumption.

My idea of a gas rate would be an accumulative rate with a readiness to serve charge in proportion to the investment per customer, and service on the part of the gas company that would insure regular inspection of appliances, and see that the right appliances are installed Many times I have found neglect on the part of servants costing the customer for gas from three to four times what it should. I have found servants warming their feet on cool days by lighting the gas oven, and I could mention other wastes.

We, as operators of manufactured-gas plants, have not watched the gas business as closely as we should, and have allowed too much drift to reduced rates with advanced prices in coal, oil and labor, and only a very slight decrease due to higher efficiency; and I sometimes think our more or less intimate connection with the electric business, where such great reduction has been made in production cost, has, to a great extent, inclined our minds to reduced rates. I believe the American people are changing their opinion of public utilities, and that they are soon going to say we must charge a rate that will show a fair return on investments, and that we must set aside sufficient for depreciation, so that we are at all times selling our product at a fair profit; and when the pendulum swings we must be prepared to meet the condition fairly.

The public sentiment on increased railroad rates is the best indication of change in public opinion; it shows conclusively that the American people all believe in making money, and do not want to be associated with losing propositions, and, furthermore, do not want anyone to be forced to conduct a business that is not profitable.

I predict a number of big gas fields being discovered in Texas, as well as large developments in the artificial gas business, during the next ten years, and I further predict advances in both natural and artificial gas rates for domestic consumption.

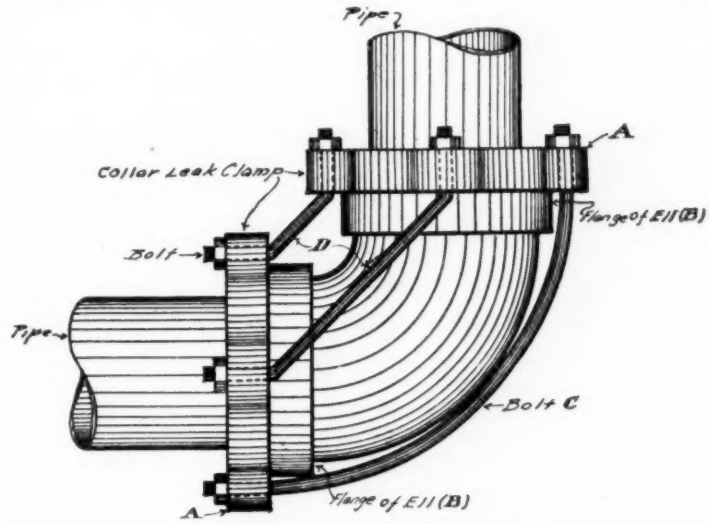
In conclusion, as both a natural and artificial gas operator, I feel our business is still in its infancy, and that we can expect wonderful development in this field during the next few years.

Large Natural Gas Appraisal.

What is said to be the largest appraisal of a natural gas property was recently completed by the Department of Examinations and Reports of H. M. Byllesby & Company. Preliminary work was started May 1, 1914, and the completed report, comprising 18 typewritten volumes containing approximately 10,000 pages, was delivered to the clients in April, 1915. The appraisal was made for the Manufacturers Light and Heat Company of Pittsburgh, Pa., which operates a system of 2,500 miles of mains, 18 compressor stations, 123 wells; and serves 90,000 customers in the panhandle of West Virginia and Southwestern Pennsylvania. The principal cities served are Pittsburgh, Wheeling, East Liverpool and Steubenville, and during 1914, the company's gas output was 1,782,416 thousand cubic feet.

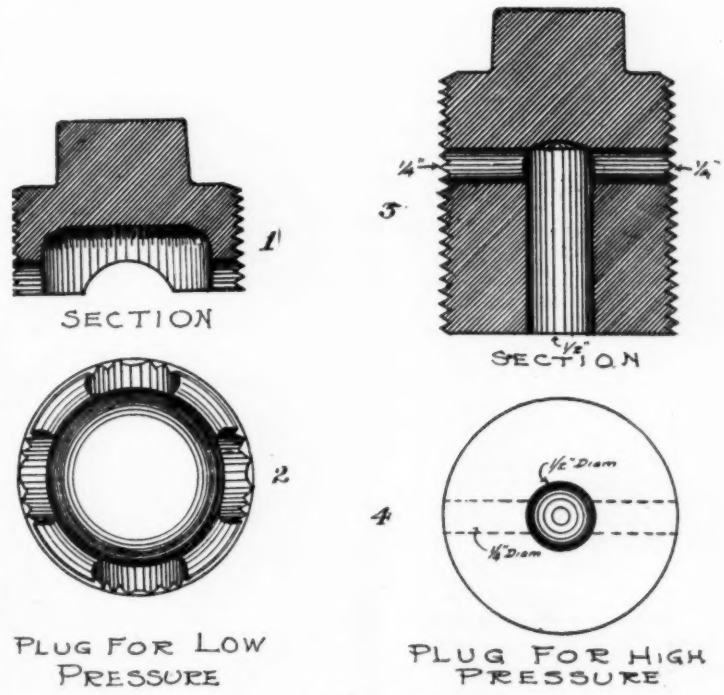
New Methods and Appliances.

TWO WRINKLES FROM THE NATURAL GAS ASSOCIATION REPORT.—Take a set of Dresser collar leak clamps and put rubbers around pipe and up against face of elbow (*B*) and collar leak clamp (*A*) up against the rubbers. Put bolts of proper lengths, with threads



To Stop Leaks in Ends of Screw Ell.

on each end, through the four bolt holes in clamp; bolt *C* to be so bent before applying that it will rest upon the ell as indicated, and bolts *D* to be bent as shown. Tighten bolts until leak is stopped.



Safety Plugs.

Sketch No. 1 is section and No. 2 end view of plug for use on low pressure lines, with ground recesses that allow pressure to escape until threads are caught, in putting it on; and allow plug to be taken out against considerable pressure without danger of blowing off.

Sketch No. 3 is section and No. 4 end view of high pressure plug, with drilled escapement holes, having effect similar to that on low pressure line.

THE luminous efficiency of light sources has been determined by Herbert E. ves as follows:

Light source.	Luminous Efficiency of the radiation	Total luminous Efficiency.
4 watt carbon lamp	0.45 per cent.	0.42 per cent.
1.25 watt vacuum tungsten lamp	1.65 "	1.3 "
0.70 watt nitrogen-filled lamp	2.93 "	2.4 "
Welsbach mantle, 0.75 p. c. "Ceria"	1.2 "	0.19 "
Open-flame gas burner	0.19 "	0.036 "

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE mid-summer meeting of the New Jersey State Gas Association will he held on Thursday, August 5th, when those attending will be guests of the Bridgeton Gas Light Company, at Bridgeton, and of the Millville Gas Light Company, at Millville.

W. A. POLK, father of Roger W. Polk, died at his home in Providence, R. I., July 18th, after a long illness. Mr. Polk was more than 80 years old, and last year celebrated his 60th wedding anniversary. He was a successful contractor and will be remembered by a good many gas men as attending the 1909 meeting of the Michigan Gas Association. Mr. Polk is survived by his wife, four sons, Edgar M. and William A., of Providence, Emery S., California, and Roger W. of Washington, and two daughters, Clara M., assistant superintendent of schools in Providence, and Bertha S. Seven grandchildren and two great grandchildren also survive him. Mr. Polk is the last of his immediate family, in which there were 19 children.

THE Central Publicity Bureau at Berlin, referring to the employment of prisoners of war in Germay, says that recently many are employed in gas works, apparently with satisfaction both to the management and to the men. Some gas works have more than a hundred prisoners engaged, including fitters, smiths and laborers, who have been taught stokers' work. The Frenchmen are specially commended, and favorable reports are made of the Russians. Certain formalities have to be gone through by works desiring prisoners assigned to them; and the Bureau offers to give inquirers information.

THE heads of the commercial departments of the utility properties operated by Hodenpyl, Hardy & Company, New York City, met in Grand Rapids, Mich., on July 26, for the discussion of commercial and sales problems. The sessions were held at the offices of the Grand Rapids-Muskegon Power Company.

THE annual figures on the manufacturing of fuel briquets has been published by the United States Geological Survey and is available for distribution. The production of briquetted fuel in the United States in 1914 amounted to 250,635 short tons, valued at $1,154,678, an increase of 37.82% over the production in 1913.

THE Long Island Gas Corporation of 50 Church Street, New York, which has lighting plants at Sag Harbor and Southampton, L. I., has filed a $5,000,000 mortgage upon its property to the Brooklyn Trust Company. Only $106,000 is drawn at this time. The rest is to be advanced as needed by the corporation.

JOHN M. BROCK is still (or yet) in the far west. At last account he was at the Panama-Pacific Exposition, with no definite time fixed for return to New York.

IT is reported that one of the big utility corporations of New York City may offer its customers the opportunity of subscribing for its shares. This is probably due to the success of the Pacific Gas & Electric Company, whose customers have taken something like $2,000,000 of its preferred stock at 82½ a share, notwithstanding that conditions have not been conducive to easy financing. The offer was made to about 170,000 individual consumers, giving them the privilege of payment in instalments.

THE Mauch Chunk (Pa.) Gas Company has doubled the capacity of its plant and will soon correspondingly increase the number of its customers.

A. M. PECK, of Elgin, has assumed his duties as manager of the Rochelle (Ill.) Gas Company. E. S. Davidson, retiring manager has been given a two months' vacation on full salary.

THE New York and Queens Gas Company has broken ground for a gas holder of 1,000,000 cubic feet capacity, at Center and Farrington Sts., Flushing. The additional equipment is necessary, the officers of the company say, to provide for the growing business.

PORTSMOUTH (Va.) gets cheaper gas, effective from August 1. The old rate was $1.25 per 1,000 with a ten per cent. discount if paid before the 10th of the month, and under the new scale the rate will be $1.10 with a discount of ten cents per thousand feet if paid before the 10th. The users of prepayment meters will not receive quite as much reduction, as the company announces that prepayment meters will be set at $1.10 without discount.

The outlook for natural gas for St. Joseph, Mo., the coming winter, cannot be determined yet. So tied up are the matters of the Kansas Natural Gas Company that no prediction can be made as to the amount of gas that will be available. "We were able to supply the demand for gas last winter," said V. L. Elbert, general manager of the St. Joseph Gas Company, "because we have a big storage capacity. The only information I have now on the situation I get out of the newspapers. I recently noticed that at the present rate of consumption, it is probable that the natural gas fields will be exhausted in six years." The St. Joseph Gas Company has asked the Missouri public service commission for the right to increase its rate for natural gas from 40 cents to 60 cents per 1,000 cubic feet, and has placed its figures for manufactured gas at $1 a thousand.

AN application for a gas franchise for Coeur D'Aliene, Idaho, has been filed with the city clerk by Attorney J. H Wourms of Wallace, Idaho, the instrument stipulating that construction work would be started within 12 months after its passage by the city council. A maximum of $1.50 per thousand cubic feet for the product would be included in the company's contract with the city. The proposed process of manufacture is understood to be distillation of wood.

GOVERNOR BRUMBAUGH of Penna. has approved the merger of five gas companies chartered to operate in Berks, Lehigh and Montgomery counties under the name of the East Penn Gas Light Co., of Philadelphia. The company will take over the East Penn Gas Light Co., Macungie Gas and Fuel Co., Fleetwood Gas and Fuel Co., Macgungie Gas Co., and Perkiomen Gas and Fuel Co. The officers are J. R, Miller, Reading, president; C. M. Harlan, Philadelphia, vice president, and J. M. Miles, Philadelphia, secretary and treasurer.

DON'T worry about the poor soldiers having to dig so many trenches. Frank V. Schoon, of Hawthorn, N. J., well known as a gas works builder, has just returned from a six months trip to the war country, where he spent about half that time showing the French how to run an American gasoline power trenching machine. Machines have dug thousands of miles of trenches for the combatants, and often work close enough to the fighting lines to have shells drop close by.

THE Lakeland (Fla.) Gas Company, of which Roscoe Nettles of Tampa is the moving spirit, has turned gas into the mains. The local paper says: "The city owns its own electric light and water plant and therefore the gas will only be used for fuel purposes, unless parties prefer it for light instead of the electricity, which is hardly probable. The coming of gas to Lakeland marks an important day in the history of the town, for many new settlers will be induced to make this their home when they find that this ideal fuel is obtainable for cooking purposes."

IT is rumored that the United Fuel Gas Company, which was purchased by the Columbia Gas and Electric Company a short time ago, will build a pipe line from Charleston, W. Va., to Washington and Baltimore, supplying those cities with natural gas from its West Virginia wells. W. Y. Cartwright, of Cincinnati, Vice-President of the United, has been in the East, where arrangements for the project are going on. There are a number of cities in Maryland and Virginia on a line to Baltimore and Washington that could be supplied, and it is probable other lines extending north, south and east from these two cities will be built when the main line is completed.

A LICENSE has been granted by the (Mass.) Harbor and Land Commission to the Springfield Gas Light Company, to lay a six-inch gas main across the Connecticut river between Longmeadow and Agawam. The document says that the pipe shall start from the shore line at Meadow street in Longmeadow, and runt o the shore

line near Woodcliff avenue in Agawam. and specifies that it must be laid under the bottom of the river, and there are the usual conditions regarding compliance with the terms and right to revoke in case of noncompliance.

THE Alton (Ills.) Gas and Electric Company has been working for a couple of months extending its gas service in the Upper Alton and Upper Middletown sections. The work was divided into three parts. Two of these, the extension of the Central Avenue main to give service on Staunton street and the extension of the College Avenue main, including service on Rodgers Avenue, have been completed and gas turned on. The extension on Main and Judson streets is now being finished, and these complete the extension for this year and bring service to many residents who have long wanted it. The work has heen completed just in time to give the patrons the benefit of during the hot weather.

EIGHTY-FIVE CENT gas for Flint, Mich., is the verdict of the Board of Arbitration, although Clinton Roberts and G. E. Pomeroy, representing the gas company, refused to sanction it. The report, presented to the city and the Michigan Light Company, bears the signatures of Edwin O. Wood, Dr. O. Mallard, the arbitrators representing the city, and Neil J. Berston, the fifth arbitrator. City Attorney Homer J. McBride, making comparisons between the appraisals of the Flint and Kalamazoo gas plants, insisted that Flint should have a maximum rate of 65 cents. John J. Carton, for the company, sought to prove that the local plant was returning less than 7% on the investment under the $1 rate.

THE Fort Madison (Ia.) Gas Company is contemplating spending $30,000 to $40,000 on improvements within the next few months, including the extension to their lines. The company intends to make many changes that will be beneficial and improve the already good service of the utility.

THE Des Moines (Ia.) Gas Company will not appeal from the decision of the Supreme Court setting a 90 cent rate. The company has notified the Mayor of the city that clerks have been put to work on the books, to ascertain who are entitled to rebates and the exact amounts. The official who conferred with the mayor said the task seems almost endless and that it is uncertain when the company will be ready to begin paying the $115,000 rebate due users of gas. The method of paying the refund decided will be taken up with Federal Judge Wade.

THE Haverhill, Mass. "Record" says: "Herbert L. Morris has taken so many orders for gas extensions, ranges, etc., that he fairly effervesces. His early morning concerts on the street car reminds us of the chansons of the French Nightingales who lumberyacked in the deep Maine woods—they are so different. He publicly challenges us to give his afforesaid concerts a proper reading notice. Besides his melodious voice, Mr. Norris is a man of splendid physique, weighs over 200 pounds, wears heavy soles on his shoes, and has a remarkable muscular development.

AT a meeting of the directors of the Hartford, Conn,. City Gas Light Company, Morgan G. Bulkeley, jr., was elected a director to succeed the late John R. Hills, and J. J. Bodell and Philip B. Simonds of Providence were elected to the board to succeed George Bullock and F. R. Bertrom. Francis R. Cooley was elected vice-president to succeed Mr. Bullock. These changes follow the purchase by Richter & Co. of this city and Bodel & Co. of Providence, of a block of the common stock of the company. There are to be other changes, as it is contemplated to increase the board of directors from nine to eleven by the election of two additional members. The present directors, in addition to those named above, are: Judge Edward B. Bennett, Sylvester C. Dunham, James H. Knight, George Roberts, Francis R. Cooley and John T. Robinson, all of Hartford.

A MASSACHUSETTS newspaper says: The Mansfield Gas Company has made application for a franchise to lay gas pipes in Foxboro.

THE matter of a gas franchise in Pullman, Wash., is still undecided. C. W. Morris has an application before the Council, but action has been postponed.

UTILITIES COMMISSION NEWS.

MAY NOT DISCONTINUE.—The Supreme Court of Kansas has ruled that no public utility under the jurisdiction of the Public Utilities Commission of Kansas can discontinue service without obtaining from the Commission the authority to do so. The case was that in which the Postal Telegraph Company had closed its office at Syracuse, Kan., claiming that in operating this office the company was losing annually $135. The attorney for the utility commission brought mandamus proceedings to compel the re-opening of the office, and the ruling was in favor of the Commission.

MUST BE METERED—Among the rules announced July 16, by the West Virginia Public Service Commission, is one that requires that all gas and electric energy sold in the State after January 1, 1916, must be sold by meter service, except in the case of window and outside decorative illumination, street lighting, transient customers and limited service of a specified kind.

NO SPECIAL RATES TO EMPLOYEES.—The New Jersey Commission has handed down a decision ordering the Farmingdale Llghting Company to discontinue the practice of allowing its officers and employees different discounts from those given to other purchasers of electrical energy.

The board finds upon investigation that widely different rates of discount have been allowed, officers and certain employees being granted a discount of 25%, and lineman a discount of over 66 % if bills were paid within the required time. The company sought to justify this discrimination in favor of its officers upon the ground that they received no salary or other compensation. The board holds that this was not a valid reason, and in its decision says:

"It has been held repeatedly that a director, stockholder or employee of a utility company is entitled to no preference or advantage in the matter of the rate he is to pay for service; the only exceptions are those expressly made by statute. They should all be charged the regular rate; matters of salaries and wages should be treated on a more businesslike basis than in discrimination in rates for service. Under the public utility act of this State, providing that no public utility shall make any unjustly discriminatory or unduly preferential rate or give unreasonable preference or advantage to any person or corporation, the practice at issue is illegal, and the company is ordered to discontinue this discrimination.

ELECTRIC WATER HEATING COMPETITION—According to the Idaho Public Utilities Commission, the Pocatello Gas Company failed to sustain its contention that the Southern Idaho Water Power Company's rate for domestic water heating was unreasonably low and below the cost of production. The Commission says:

"The issues in this case resolve themselves into one question: Is the rate charged by the defendant company for water heating purposes unreasonable, compared with the rate charged for other uses? This can only be determined by a valuation of a company's system and an investigation into the cost of generating and delivering the several classes of power. This commission is not in a position to do this on account of the failure of the Legislature to make an appropriation with which such an investigation might be carried on. Evidence was introduced to show that the average per K.W.H., at the consumers' meters in Pocatello was about 1 cent, and that the rate charged water heater users, if the heater were used on high for 24 hours of the day would only be 2½ mills per K.W.H. That this class of service is, therefore, furnished for about one-fourth of cost and, therefore, must be unreasonable. The premises from which that conclusion is drawn have not been substantiated by proof.

"The defendant contends that the real question at issue is the reasonableness of its rate for this class of service; and that the commission has no jurisdiction to proceed, and in that connection relies on Section 56 of the Public Utilities Act.

"Under this section it would seem that defendant's position is well taken. The complaint was not made by this commission on its own motion, nor was it signed by the Mayor or Pocatello, or by a majority of the City Council, or by 25 consumers of purchasers of either of the companies. The complaint is signed solely by a competing company, which, in so far as the evidence shows, is not a patron of the power company.

Financial Notes.

THE Michigan Railroad Commission authorized the THORNAPPLE GAS AND ELECTRIC COMPANY of Hastings to increase its capital stock from $100,000 to $500,000.

THE PEOPLES GAS LIGHT AND COKE COMPANY has declared the regular quarterly dividend of 2%, payable Aug. 25, to stock of record Aug. 3.

AS the outcome of financial difficulties of THE DOVER, ROCKAWAY AND PORT ORAM GAS COMPANY, the plant in Dover, N. J., and all its appurtenances in that and adjoining muncipalities, will be sold under foreclosure, August 16.

The mortgage foreclosed is a second lien given to secure a second bond issue of $90,000 par value, on account of which there was owing $109,087.50, when the foreclosure decree was made May 10 last; after Addison Ely, of Rutherford, president of the company, had withdrawn an answer filed by him in which he contested the foreclosure on the ground of usury. The foreclosure suit was brought by the Fidelity Trust Company as trustee at the instance of Alfred E. Watson, president of the White River Savings Bank, of White River, Vt., and two others, the three being the holders of seventy-eight of ninety bonds of $1,000 each, covered by the trust mortgage sought to be foreclosed. The delay in following up the foreclosure was due to efforts to bring about a settlement of the company's financial troubles without recourse to a sale.

Since that foreclosure decree was made, however, default in the payment of interest on a first bond issue of $100,000, secured by a first trust mortgage also held by the Fidelity as trustee, has resulted in another foreclosure proceeding, in which a decree is due to be made. The amount due on the first mortgage bonds is $106,638.90.

SAN DIEGO CONSOLIDATED GAS AND ELECTRIC COMAANY, a subsidiary of Standard Gas and Electric Company, for the first half of 1915 reported an increase of 48% in electric output, as compared with the first half of 1914, while the consumption of gas increased 10%. A considerable part of the increase in electric output for 1915 was due to the demands made on the company for current by the Panama-California Exposition at San Diego.

THE WORCESTER GAS LIGHT COMPANY, at a special meeting of stockholders, voted to authorize the directors to petition the Board of Gas and Electric Light Commissioners for a $1,000,000 bond issue, to take up the indebtedness caused by improvements, which is carried by promissory notes aggregating between $500,000 and $1,000.000.

COMBINED net earnings available for dividends for subsidiary companies of MASSACHUSETTS GAS COMPANIES for June were $254-229, an increase of $33,865, or 15.37% compared with corresponding month a year ago. Net earnings for fiscal year ended June 30, were $2,676,583, compared with $2,524,043 in previous year.

THE WISCONSIN GAS AND ELECTRIC COMPANY, owning and operating the gas utilities in Racine, Cudahy and South Milwaukee, and the gas and electric heating and railway utilities in Kenosha, has arranged to increase its issue of first mortgage bonds by $350-000, to enable it to finance a portion of its floating debt, representing new construction undertaken since its issue of securities in 1912. The company also proposes to increase its capital stock by $150,000, to place it in position to secure the electric utility in Burlington and the gas and electric utility in Watertown, including a 28-mile electric transmission line serving power to various cities south of Watertown. The price at which the Burlington and Watertown properties will be required, if approved by the railroad commission, will be advantageous to the company.

THE UNITED GAS AND ELECTRIC CORPORATION has purchased and surrendered to the Fidelity Trust Company, trustee under its collateral trust agreement securing its $5,500,000 three-year 6% notes dated April 1, 1915; $1,000,000 of these notes for cancellation. This action anticipates its obligation under the agreement in respect of the redemption and cancellation of $500,000 of these notes on or before July 1, 1916, and of $500,000 more to be redeemed and cancelled on or before Jan. 1, 1917.

THE WASHINGTON GAS LIGHT COMPANY declared a regular quarterly dividend of $1.20 a share, payable Aug. 2.

GROSS earnings of the SIOUX CITY GAS AND ELECTRIC COMPANY for the first six months of 1915 were $279,815.51. Statement of the earnings is carried in a letter from L. L. Kellogg, manager of the company, to the mayor and city council. Under two separate provisions the city receives 2% and 1% of the gross earnings of the company in return for certain ordinance concessions granted, and the city's share for the period will be $8,394.46.

MUNICIPAL GAS COMPANY OF ALBANY declared a dividend of $64 on each of its old and new shares of stock, which is equivalent to 151%. Stockholders of record May 22, participate in the payment. The dividend was the accumulation of surplus earnings for 20 years.

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